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92MI0129A Bonn DIE WELT in German 19 Nov 91 p 18

[Article by Anatol Johansen: "Manned Space Flights in Europe—Quo Vadis?"]

[Text] Werner von Braun, who died in 1977, expected in all seriousness that manned space flight would have the effect of preventing wars: He felt the costs of astronautics would be so high that it could only be financed over the long term by cuts in military budgets.

Unfortunately, however, there are no signs anywhere in the world of military expenditure being reduced in favor of space flight. If this were to happen, the particular beneficiaries would be the German politicians and officials with responsibility for space flight who would be relieved of the heavy burden they currently have to bear.

This is because next Monday (18 November 1991) sees the start of the three-day conference at the Alte Residenz, Munich, of the European Space Agency (ESA), to agree on its space program for the next three years.

Though the aims of this long-term project were finally settled as long ago as 1987 in The Hague, it has not been possible to say the same of its financing, which remains uncertain—a fact which piques the Germans, who are one of the nations bearing the brunt of the costs.

In 1987 ESA reckoned the total costs of its ambitious Horizon 2000 project (consisting of the Ariane 5, Hermes and Columbus projects) at around 60 billion German marks [DM] (32.5 billion European currency units [ECU] at 1986 exchange rates), of which Germany was to pay around a third. This would also have necessitated a further increase, to around DM25 billion, in the German space budget—already substantially increased, and currently in the region of DM1.5 billion per year: an impossible sum to meet in view of the annual costs in excess of DM100 billion for the new laender, quite apart from numerous other expenditure.

In addition, the costs of the projects themselves have soared far beyond what was expected. For example, the deputy research spokeperson for the SPD [Socialist Party of Germany] parliamentary group, Edelgard Bulmann, has complained that at the present exchange rates the costs of the Hermes space shuttle amount to DM15.4 billion—which, compared with the figure of only DM9.1 billion quoted in 1987, amounts to an overshoot of 70 percent—or 40 percent even after exchange rate adjustments.

At this cost, the European space vehicle could be due to be shot down in flames, considering that the agreement of 1987 gives any ESA member state the right to pull out of the agreed overall project if it proves unable to meet its preset technical specification and required performance criteria, or if the agreed budget is exceeded by more than 20 percent.

It is uncertain whether anyone will go that far in Munich. A significant additional factor is the slight divergence in German and French attitudes: For instance, the planned small space shuttle Hermes is a pet project of the French, who gave the impetus to the ESA's "Europeanization" of this originally French project so as to enable the costs to be shared by member states. The Germans are currently unable to find their share of the money for the small space vehicle, however.

The European Space Agency has however taken account of the financial problems facing Germany and the other member states, and is working on a new long-term plan to be discussed in Munich: It no longer envisages expenditure to the year 2000 of DM66 billion (ECU32.5 billion) as agreed in 1987, but only of around DM60 billion.

Even this reduction is not very helpful, however, as it will also involve the long-term project's extension to 2005, rather than terminating in the year 2000 as previously planned. This would make the overall costs to 2005 even higher than anticipated in the 1987 plan, amounting to almost DM80 billion (ECU38.7 billion at 1990 exchange rates).

At 1990 prices, which now form the basis for ESA budgeting, the Columbus project will cost DM10.3 billion (ECU5.06), the space shuttle Hermes DM15 billion (ECU7.320), and the Ariane 5 rocket DM9 billion (ECU43.40). As reported yesterday by the Federal Ministry of Research and Technology, according to the latest figures Germany would henceforth have to contribute DM2 billion for the Ariane 5 rocket, DM3.9 billion for the Columbus space station project, and DM4.1 billion for the Hermes space shuttle for the period from 1992 until 2005. This still greatly exceeds the Bonn government's budget, however.

No wonder, then, that Germany appears notably less keen on the Hermes project than the French, especially as the total weight of this small space vehicle, which in contrast to American space shuttles does not have its own propulsion, is now twice the 12 tonnes originally planned and has a smaller payload, the extra weight requires continual increases in the thrust from the planned launch rocket, Ariane 5.

It remains to be seen how ESA will find a way out of its budgetary predicament over the next few weeks. Federal Research Minister Heinz Reisenhuber has again suggested a new technology project, of several years' duration, at least for the Hermes space shuttle, the most expensive project. One of its aims would be to look into whether Hermes can actually be implemented as previously planned, albeit only by computer and on paper, or whether there is cause to fear further cost escalations beyond the substantial ones already incurred.

Meanwhile, ESA has already done a great deal to indicate its willingness to compromise, and seems prepared to agree on the current estimate for Hermes in Munich.

If this figure should be exceeded in the future, however, then any ESA member state would be entitled to pull out of the project.

Whether this will be sufficient to save the long-term ESA project in its intended form, or whether everything will have to be reconsidered from the ground upwards, will become clear during the conference at the Alte Residenz in Munich. At all events, in the course of German-French bilateral consultations in Bonn yesterday Federal Chancellor Helmut Kohl and French President Francois Mitterand stated that the representatives of their respective governments should now be calling in Munich for the overall long-term ESA project to be reexamined.

Federal Research Minister Heinz Riesenhuber interpreted this as meaning not that the current groundwork should be halted, but that in the light of the changing political face of the world and of financial realities, the projects would have to accept further detailed examination and, if necessary, modification with support from new partners if ESA were to agree in Munich to this German- French concept. A further meeting of the ESA council of ministers is due to take place at the end of 1992, where a final decision on the long-term project would have to be taken.

A total collapse of plans for manned European space flight is out of the question: Kohl and Mitterand made this clear yesterday in Bonn: France and Germany remain interested in continuing activities in the field of manned European space travel.

Riesenhuber: 'Munich Success'

92MI0129B Bonn DIE WELT in German 21 Nov 91 p 11

[Text] Representatives of Germany's space industry can "live well" with the results of the ESA [European Space Agency] Council of Ministers Conference that ended yesterday. Federal Research Minister Heinz Riesenhuber spoke of "the Munich success": Until the year 2004, ESA will hold to its long-term space program, with the major Hermes (space taxi) and Columbus (space station) projects as its "strategic framework."

Nevertheless, a final decision will only be made at the next ESA conference in Spain at the end of 1992, said ESA Director General Jean-Marie Luton in his summary of the outcome of the three-day talks in the capital of Bavaria.

The major component of the long-term program is that, in the future, international partners such as the Soviet Union and Japan will be included in ESA' division of work. Possible areas of cooperation, both tachnical and financial, would be investigated shortly, said Luton, although the contractual details of this form of cooperation remain the prerogative of the respective national partners.

Apart from the question as to whether the new partners will become ESA members or not, the European Space Agency has thus opened "the door to additional cooperation," as is already the case with the United States, said Luton.

The ESA Council of Ministers had already agreed last Thursday on a five percent budget cut for the coming year to take account of the strained financial position of some of the partner countries—including the FRG. The budget cut works out at a total of ECU120 million.

Research Minister Riesenhuber had pointed out to his opposite numbers in Munich that, at DM1.13 billion, Bonn would be paying 16 percent more to ESA in 1991 than last year. But the accounts were still about DM120 million short. Despite the 2.5-percent growth rate promised by Finance Minister Theo Waigel for the years 1993 to 1996, Germany has a funding deficit of more than DM1 billion. However, this decision to prune the ESA budget meant that Bonn will be able to save some DM70 million in the coming year.

Although the aims and orientation of the existing space program remain untouched by this decision, it may involve delays in some individual cases. In view, of the fact that, for example, the expensive Hermes space taxi is nevertheless scheduled to make its first flight in the year 2002, Horst Rauck reckons that it will only make "slight alterations to the budget projection" for his company.

Munich-based MAN Technologie AG, of which Rauck is chairman, is currently engaged in producing components for the Hermes and on development and production projects for the Franco-German Ariane booster rocket. "The ESA decisions are positive for us," is Rauck's verdict on the outcome of the Munich meeting.

Furthermore, the ESA decision to launch a special earth observation program focusing particularly on atmospheric and climate research by 1997-8 opens up new fields of activity for the aerospace industry. To this end, the ministers approved the so-called POEM 1 program, under which a platform equipped with earth observation instruments will orbit the earth with support from the American space station Freedom. The orbital environmental protection project will thus carry on the ESA's so-far successful ERS-1 satellite program.

German Participation in Major ESA Space Projects Called Uncertain

91MI0554 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 12 Sep 91 p 3

[Text] The Federal Government is finding it difficult to reach a decision on whether to continue participation in the Hermes and Columbus space projects as part of the European Space Agency's [ESA] long term program, according to its reply to a written parliamentary question from members of the SPD [Social Democratic Party] parliamentary group. For one thing, as a result of unification, the Federal Republic was faced with the high financial burden of economic reconstruction in the new laender. For another, the ESA had not yet succeeded in making 15 to 20 percent savings on the original plans by

the year 2000 as the Federal Republic had requested. The Hermes project in particular had seen its costs rise. Moreover, the American space agency, NASA, had in the meantime simplified its plans for a space station in order to save on construction and operation. Also, greater emphasis was being placed on extending earth observation by satellite in environmental research. Against this background, the Federal Government and the German space authority DARA [German Space Agency] had produced "updated guidelines" for Germany's space planning. These guidelines, the Federal Government went on, envisaged that the Columbus and Hermes projects would be considerably slimmed down and the European laboratory, which is to dock with the international space station, would be smaller than originally planned. Earth observation was to play a greater part in the German program and the ESA earth observation program had to be made more efficient. The capacities of the new laender would also have to be included and cooperation with the Soviet Union stepped up.

The program as currently planned was expected to cost a total of 25 billion German marks [DM] by the year 2000. The budget appropriations for 1992 and medium-term planning up to 1995 followed these guidelines. If Germany left the Columbus program, the Federal Government would have to share in the costs for the remainder of the first phase. These amounted to DM225 million for 1991 and about DM90 million for 1992. Pulling out would necessarily entail the loss of jobs for almost all the people employed on the project, the Federal Government said. Neither were there at present any alternative employment prospects, since everyone involved assumed that the space projects would continue. Withdrawal would also entail "an irrecoverable loss of most of the expertise in the German space industry," which would leave the Federal Republic far behind the other European partner states. If Germany pulled out of the Hermes program, the DM54.8 million promised at the beginning of this year would still have to be paid, the Government said.

European Space Programs Face Financial Difficulties

92MI0076 Duesseldorf HANDELSBLATT in German 30 Oct 91 p 6

[First paragraph is HANDELSBLATT introduction]

[Text] Parts of the large-scale projects planned by the European Space Agency (ESA) for the Hermes space glider and the Columbus laboratory system are becoming considerably more expensive than originally estimated.

The head of the German Space Agency (DARA), Professor Wolfgang Wild, confirmed at a press conference in Bonn on Tuesday that Hermes' "exorbitant" rise in costs, calculated in European currency units [ECU] amounted to 40.5 percent, with some 14 percent for Columbus. This means a cost for the space glider of at least 15 billion German marks [DM] if the project is to gain continued approval at the meeting of ESA ministers planned for 18/19 November in Munich.

Wild denied reports that the cost increase for Hermes was as high as 69.3 percent in comparison with the ESA long-term program for 1987. He did admit however that "costs were underestimated" at the meeting in the Hague where the decision was taken to start the project proposed by France. Furthermore, the project's extension into the next century would lead to higher costs.

According to the figures he quoted, the same applies to the Europeans' Columbus contribution to the manned U.S. space station Freedom. Planning so far has assumed that it will consist of a space laboratory intended to dock with the space station, an independent laboratory platform and a socalled polar platform; the independent laboratory is to be provided by Hermes.

The head of DARA made clear that France would certainly not wish to be involved in this laboratory platform if Germany were to withdraw from the Hermes project for reasons of cost. An important preliminary decision is expected to be made at the Franco-German summit meeting on 15 November immediately before the ESA conference.

With the cost of the large-scale projects now running into billions, the opposition in Bonn is particularly critical of the ESA program, in view of the fact that the projects' funding has still not been included in the medium-term budget. Though the Bonn government was incurring costs of almost DM17 billion, only a few days ago the German space industry warned against abandoning the ESA large-scale projects on the grounds of cost.

DARA's chief executive for space exploitation, Professor Heinz Stoewer, pointed out that, with the support of the UN General Assembly, space agencies from over 30 countries have declared 1992 to be "International Space Year" with the aim of making the public throughout the world aware of the benefits of space travel, including benefits for the environment.

According to Stoewer, Germany will be involved in some 100 projects during International Space Year, and, under the patronage of Federal President Richard von Weizsaecker, a conference is planned for the start of April in Munich on the theme "space travel in the service of the changing world."

Airbus A340 Maiden Flight Discussed

91AN0546 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 5 Sep 91 p 3

[Article by Gerard van Nifterik: "Introduction of Airbus 340 To Undermine Traditional U.S. Supremacy"]

[Text] Later this fall, Europe will present its answer to the Americans' long-standing supremacy in the field of long-range air transport. The A340—the latest model in Airbus Industrie's A300 series—will make its maiden flight in October: This constitutes a landmark in the evolution of the postwar European aircraft industry.

The A340 is one of two airplanes which are currently being developed within the A330/340 program by a consortium of European aircraft builders operating

under the name Airbus Industrie. Both types—the A330 is scheduled to make its maiden flight in 1992—are intended to complete the A300 line. Previously, the European consortium had already developed the A300, A310, and A320.

The A340 is the first product of Airbus Industrie—a consortium of French, British, German, and Spanish aircraft manufacturers—offering a long-range capacity for roughly 300 passengers. It allows Europe to enter a market sector in which American aircraft builders—in particular Boeing with its legendary 747 Jumbo—had a virtual monopoly so far. Over the next 15 years, the potential market for such aircraft is estimated at 2,100 units, of which Europe aims at acquiring a 22-percent share.

Laborious Assembly

For the production of the A340, Airbus built the largest and most advanced assembly line in Europe near Aerospatiale's plant at Colomiers on the outskirts of Toulouse. The factory was officially opened last year; it consists of a 6-hectare assembly hall, an unloading area for the Superguppy freight aircraft, a storage area for semifinished parts, and two paint spraying installations.

Assembling an A340 is a rather complex operation, not in the least because the different parts must be flown in from all over Europe with the Superguppies: the nose and the central section of the hull from Saint Nazaire; certain wing parts from British Aerospace; and the wings from Deutsche Airbus (Bremen). The assembly line in the 46-meter high assembly hall is the first one to use robotics on a rather extensive scale.

Robots

For instance, in work spot 40 of the assembly line, robots are used to fasten the wings to the hull, while in assembly spot 35 the hull is assembled using robotics.

The wings—which consist of light-weight metal, structural elements—are first positioned along both sides of the hull. The assembly spot is equipped with eight digitally controlled robots: two underneath and two on top of the wing at either side of the hull. These robots are provided with laser-guiding equipment; they prepare the fastening points, which involves drilling holes and make the threadings (a few thousand per aircraft). The actual fastening is done manually.

Assembly spot 35—hull assembly—is equipped with four robots. Two of them fix the nose to the hull, the two others make the connection between the hull and the tail unit. The robotics system, the hard- and software of which were developed by Game Ingenierie, makes it possible to make as many as 12,000 fastening points within one single, 15-hour cycle. The robots drill a hole, apply a sealant, and insert a rivet into it. The final fastening is done manually.

Test Period

Although later this fall the first A340 will be airborne, extensive testing operations are still to follow.

Airbus Industrie expects that all certificates of airworthiness will have been granted by the end of next year. Two years later, the A330 will be launched; this is a medium-range aircraft powered by two Pratt & Whitney PW4000 engines. Later on, this type will probably be equipped with the slightly more powerful Trent engine from Rolls Royce. The aircraft will be capable of carrying 355 passengers over a distance of 8,900 km. The aim is to conquer almost half of the medium-range market with the A330, the A300, and the A310 together. In addition, Airbus Industrie is considering to upgrade the capacities of both the A340 and the A330, one of the objectives being a range extension of the A330 up to 10,000 km. In the long run, the hull of the A340 may be enlarged, which would enable the aircraft to carry 335 passengers over a distance of 11,000 km.

A spectacular expansion of the Airbus family is projected for the next century. The consortium is considering the possibility of building a giant aircraft, the A350, which should be capable of carrying 600 to 800 (and possibly 1,000) passengers.

[Box]

Engines, Electronics, and Maintenance

As far as technology and capacity are concerned, the A340 is the finest passenger aircraft ever built by the European aircraft industry.

Initially, Europe's latest asset will have four CFM56-5C2 engines from CFM International. In a subsequent stage, these engines will be replaced by the slightly more powerful CFM56-5C3. As a matter of fact, the engines have a serious impact on the aircraft's price: A set of four CFM jets accounts for one-third of the aircraft's price.

There will be two versions of the A340: one for very long distances (14,000 km) and one for slightly shorter distances (12,500 km), which will however have a higher passenger capacity. The aircraft is stuffed with advanced electronics, as developed earlier for the A320, the fdeveloped the Flight Management and Guidance Computer (FMGC) and the Flight Control Unit (FCU).

A new feature is the central maintenance support system, the Central Maintenance Computer (CMC), which holds data on the aircraft's condition. After every irst aircraft in civil aviation to fly entirely electronically (fly by wire). This system has now been adapted to the four-engine A340. The flight computers were supplied by Airbus' own department (ADL) and by the French company Sextant Avionique, which mission, this computer draws up a kind of flight report and orders the necessary maintenance operations based on that report. In addition, Airbus is also developing an Electronic Library

System (ELS) which can handle more than just maintenance support. ELS uses optical data processing and acts as an electronic library, e.g., for preparing flight plans and navigation maps.

Robots Used in Final Assembly of Airbus 340/330

92WS0050A Landsberg PRODUKTION in German 12 Sep 91 p 8

[Article by Marc Ferretti: "A New Application Field"]

[Text] Toulouse—At the end of October the new Airbus type A 340/300 [sic] will make its maiden voyage. It will not only be to demonstrate a new aircraft model, but an assembly method will also celebrate its debut: For the first time robots are being used in the final assembly of an aircraft.

"The use of robots lowers the overall costs for the aircraft," explains the production chief of the A330/340, Frederic Ribere. "It has immediate impact on the work organization and makes it possible to reduce the personnel in comparison with conventional methods. Furthermore, assembly robots increase product quality, improve repeatability accuracy and make the work considerably less strenuous." Technically interesting are above all two stations which are equipped with assembly robots, stations 35 and 40. About the latter: The wings, whose carrying components are made of a light metal alloy, are positioned on both sides of the central fuselage section. About 3,000 fastening elements are required for connection on the upper- and underside of the airfoil. The position of the fastening points is determined by an assembly installation which is called the grid.

On this grid there are finder sleeves for the tools that make the mounting holes at the prescibed locations. Into one of these finder sleeves a mobile robot with six degrees of freedom leads an automatic drilling machine, which it has first taken from a hopper rack with a total of 120 drilling machines. Each of these machines weighs about 20 kg; the robot itself can handle tools up to 25 kg. As soon as the hole is drilled and correct, a worker brings up the particular fastener. Each drilling machine is controlled by a programmable automatic device and is only intended for a very specific type of assembly hole. Wear on the drill that is used is monitored by a torque check sensor on the electric feed motor. While one drilling machine is making a hole, the robot is already conducting a second drilling machine into the next finder sleeve. For this purpose the robot's gripping pincers have a sighting device based on a laser, with which it corrects the continuous-path control along the grid. This device aligns fixed reference points, so that the robot can automatically compensate for the unavoidable measurement deviations between two aircraft.

The described station has eight robots: At left and right there are two robots each on the upper and under sides of each wing. They run on tracks which are laid on a portal stand. Each of these eight robots possesses its own digital control. These controls are connected with each other in a local network of the Ethernet type and with the master computer.

The master computer works with a specific program which was developed by the Socoa company and which includes all drilling parameters and drilling operations. Since all machine tools are also connected to a local Ethernet, this opens up the possibility of future computer-integrated manufacture. The entire computer architecture of this assembly station was designed in cooperation with the Socoa company in order to assure optimal integration of the manual and robot-supported work phases. The result weighs about 50 tons and its contours already resemble the aircraft. The completed assembly group is grasped by a conveying bridge and moved to assembly station 35.

The second robot-supported assembly station is equipped with four special robots. Here the circular connections on the one hand between the central fuselage section and the nose section and on the other hand between the central fuselage section and the tail section are produced. One robot takes over drilling or boring the rivet holes on each side of each of these two points of connection. Each circular point of connection consists of 6,000 attachment points.

The total of 12,000 attachment points are made in only 15 hours. This robot facility was developed by the Game Ingenierie company. The robots run on double tracks and are positioned by runners and pneumatic elements. They are controlled by a programmable automatic device with separate entries and exits. Each robot has an optical sensor system with which the necessary reference points in the form of dowel pins on the fuselage are located and the precise distances between the attachment holes can be calculated.

Each robot drills a hole, applies a sealing compound and inserts a fastening rivet. A worker monitors all the labor steps from the interior of the fuselage, visually examines the quality of each fastener hole and takes over placement of the inserted rivet.

The rivet consists of a threaded bolt with a built-in weak link. The setting device positioned by the robot tightens the matching nut until the weak link yields, after which the projecting piece is sheared off.

The break at the weak link simultaneously delivers the signal to the master computer to head for the next attachment hole.

This type of work is also described as closely interlocked manufacturing. "While in traditional assembly six workers are required per point of attachment, by using robots the number is reduced to two," Frederic Ribere points out as the advantage of this method.

Since the landing gear can also be installed in parallel with these steps, the now completed aircraft can be rolled on its own wheels to assembly station 30. This station is based on a modular concept and at present consists of three substations for undertaking the tests described

above. A fourth substation can be installed if needed, if the number of aircraft produced each month should increase.

Normally the retraction and extension tests for the landing gear are carried out on suspended aircraft. On the other hand, it is difficult to work with a suspended aircraft. That is why at Airbus Industries these tests are done in pits, while the aircraft itself is propped up at its normal height with hydraulic cylinders.

Austria's Participation in Future ESA Projects Outlined

92MI0131 Vienna
BUNDESWIRTSCHAFTSKAMMER PRESSE
in German 20 Nov 91 p 1-3

[Text] Austria's suppliers of space technology have good prospects for strengthening their position in the promising sectors of space technology, namely earth observation, telecommunications, and the development of space transportation systems in the years ahead, even though Austria has no large combines with a developed tradition in the field, Dr. Georg Serentschy, Chairman of the Association of Austrian Space Industry Enterprises "Austrospace" said at a press conference Wednesday at the close of the ESA [European Space Agency] ministerial conference in Munich.

Serentschy believes Austrian enterprises have a good chance of being involved in the commercial exploitation of the current development phase of the Ariane-5 program. Arianespace, the company which markets the Ariane launches, now holds 50 percent of the world market for all commercial rocket launches. Enterprises that have been involved in developments connected with ESA's Ariane project are allowed to acquire shares in the company. Since several Austrian enterprises are working on development contracts for the ARIANE 5 program, that gives them the possibility of participating in its subsequent commercial exploitation.

The European Space Agency, ESA, is also the driving force behind later commercial developments in other sectors, telecommunications, for example. Its various infrastructure projects, such as Columbus, Hermes, or the data relay satellite program DRS are, however, interrelated, so that delays in one project also entail delays in all the others.

Austrian firms have so far carried out orders to the value of 1.15 billion Austrian Schillings [Sch] in connection with ESA projects—the coefficient of return if 0.95. This means that 95 percent of the contributions that the Republic of Austria pays to ESA come back to Austrian industry in the form of orders. This puts Austria well in the European mid-field.

On Thursday the "Small Country Workshop" of smaller European space enterprises begins in Vienna. Around 30 representatives of small and medium-sized European firms will be discussing their companies' strategy in the context of the ESA programs. Serentschy believes that the next few years will see a number of strategic alliances in this sector too, just as among the big suppliers. The "big boys" in the space business are moving closer together in order to strengthen their position in international competition. Nevertheless, many small European suppliers of space technology do not see their future as lying solely in being bought up by large firms, but rather in the role of specialists, making them indispensable to the large suppliers in the international, commercial space business.

According to Serentschy, the latest decision by the ESA ministerial conference is the material basis for the European space industry to assert its position against the powerful US competition even in a single European market open to international suppliers. If the ESA program for the next 12 years is carried out, it can be assumed that Europe will spend about Sch45 billion a year for the continuation of its own space programs. About 1 percent of this will go to Austrian firms and research institutions in the form of orders on the strength of Austria's participation in this European organization.

German Aircraft Turbine Combustion Chamber Cuts Emissions

91MI0557 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 12 Sep 91 pp 9-10

[Text] For economic and environmental compatibility reasons, aircraft engines are being designed for maximum compactness and lightness and good overall efficiency. Both these requirements make for engines with optimized consumption. One of the research projects funded by the BMFT [Federal Ministry of Research and Technology] therefore set out to develope a short, compact reverse combustion chamber for a 1,000-KW class demonstration engine. Its point of departure was the reverse annular combustion developed under the BMFT-funded project entitled: "New combustion chamber technologies designed to use future alternative fuels." By shortening the flame tube by about 25 percent to a length-to-height ratio of 1.63, the engine weight can be reduced by approximately 2 kg; depending on engine weight; this corresponds to 1-2 percent overall weight. In spite of the extremely short combustion chamber, it was possible to maintain the high degree of combustion efficiency. This results in extremely low emission values for CO, unburned hydrocarbons, and smoke and economic consumption of the fuel used.

The working capacity of the combustion chamber was demonstrated under realistic operating conditions up to an internal pressure of 13 bar. Its ignition capacity was successfully tested at simulated altitudes of up to 4,000 m at temperatures of down to -50°C. The possibility of a reduction in NO_x emissions was investigated using several test sequences. Lean combustion reduced the NO_x level by approximately 14 percent.

The project was part of the BMFT's civil aviation technology component program. It represents the concluding phase of a three- part development program. The final phase was carried out from the beginning of 1987 to

the end of 1990 with an expenditure of approximately 5.8 million German marks [DM], 50 percent financed by the BMFT.

The technological development of aircraft gas turbine combustion chambers shows a clear trend towards short-design combustion chambers. The length-to-height ratio of combustion chambers has decreased in the last 20 years from its initial three or four to approximately two. The aim in the future will be to reduce it even further. This will require new combustion chamber technologies and improved design methods, without which future engine projects cannot be carried out competitively.

The success of the component development program represents an important step towards aircraft engine system capability in Germany. The combustion chamber has in the meantime passed its acceptance tests during engine flight testing. These positive findings also from the basis for the comprehensive work focusing on combustion chambers planned with BMFT funding on "Pollutants Arising From Aviation."

Further details can be obtained from H. Viebcke at the BMFT Aviation Research Project Support Service at the Industrial Plant Operating Corporation, Einsteinstr. 20, 9012 Ottobrunn, Tel. 089/6088-3966.

Italian ESA Official on Program Delays

91MI0551 Rome SPAZIO INFORMAZIONI in Italian 18 Sep 91 pp 2-3

[Interview with ESA Inspector General Massimo Trella by SPAZIO INFORMAZIONI: "Projects Delayed Slightly To Resolve Economic Difficulties"; first paragraph is SPAZIO INFORMAZIONI introduction]

[Text] The atmosphere is hectic these weeks in Rue Mario Nikis, in Paris. At the headquarters of the European Space Agency (ESA), Director General Jean Marie Luton and his closest advisors are working, with some difficulty, on the contents of the new 1992-2005 Long-Term Program which should entail an estimated expenditure of roughly 47 billion European currency units [ECU]. And the economic aspect is indeed the main obstacle, after the clear-cut statements of austerity made by Germany, Italy, and other countries. Luton maintains that he has already found a solution: But, for the time being, it is top secret. The secret, in fact, will be revealed next 18 and 19 November in Munich, at the ESA's ministerial conference. However, this solution will probably involve limiting any increase in the financial commitment over the next few years, and simultaneously postponing various European space programs. SPAZIO INFORMAZIONI recently asked ESA Inspector General Professor Massimo Trella to express his opinion on this important issue. The following is the text of the interview.

SPAZIO INFORMAZIONI: The ESA ministerial conference will take place in Munich next November. How do you view the current situation?

Trella: The problem that still remains to be resolved at this time is the financial resources that the leading participants of the European space cooperation are willing to allocate. Both Italy and other major contributing countries have problems to solve before providing an effective response to the rate of expenditure envisaged for the coming years. The participants in the European space program must still reach an agreement on this issue before developing an economically acceptable program.

SPAZIO INFORMAZIONI: The ESA executive council's plans appear to involve extending the various programs over a longer period of time. What is your opinion? And how can this decsion be reconciled with the space station Freedom which is being developed in cooperation with the United States?

Trella: In effect, the only possible way of resolving these difficulties, which we believe are economic and are particular to this stage in political decision-making, is by slightly postponing the completion of programs. These delays are compatible with the goals to be pursued and furthermore, with the sound management of this complex development program. We believe that we have succeeded in finding a solution to the problem of compatibility with NASA's Freedom project. The matter had indeed caused some concern over the past few months. Now, however, we are more optimistic, in light of the decisions taken by the United States government. Consequently, in our view, there is no inconsistency between our Columbus development program and the Freedom project. On the other hand, we are still confronted with difficulties concerning our ability to proceed immediately in the wake of the decision taken at the ministerial conference, with the translatlantic cooperation program and all other other elements of the European program, which covers the scientific sector, Earth observation, telecommunication, and Hermes.

SPAZIO INFORMAZIONI: What is Italy's role in this context?

Trella: Italy's role is vital, essential. Today, the mere idea of space cooperation in Europe without Italy playing a leading role is simply inconceivable. Italian industry has grown significantly over the last few years, and now has a clearer view of its goals and ambitions. European space cooperation is currently unthinkable without Italy's active involvement. And this will determine Italy's share in the ESA's programs.

SPAZIO INFORMAZIONI: On the basis of your long experience, do you think this is the toughest time for European space activities since the establishment of the ESRO [European Space Research Organization]?

Trella: It is difficult to make a quantitative assessment. All space programs undergo extremely critical moments constantly. There is a certian amount of risk associated with programs for the development of these technologies, in that they are the driving force of the entire process of industrial and scientific developemnt and, therefore, entail critical stages. We have witnessed other

such instances, such as the ELDO [European Launcher Development Organizations] crisis, the establishment of the ESA itself, other ministerial conferences which failed to achieve what they set out to accomplish. In some cases, ministerial conferences, such as the Brussels and Bonn conferences, failed to produce concrete decisions. This is therefore a critical time. The decision that will be taken will accompany or affect us for the next 10 years and is, of course, of extreme importance.

BIOTECHNOLOGY

Finland: Biodegradable Implants for Bone Surgery Developed

92P60042 Frankfurt/Main FRANKFURTER ZETIUNG/BLICK DURCH DIE WIRTSCHAFT in German 22 Oct 91 p 8

[Text] Under the leadership of Professor Pertti Tormala of the Laboratory for Biomaterials at Tampere Technical University (Finland), new biodegradable implants are currently being developed which, apart from their application in bone surgery, lead to the expectation of a broad spectrum of applications. As Tormala reports, here, one is dealing with polymers based upon polylactides and polyglycolides to which, according to their specific applications, a definite proportion of hydroxylapatite is added.

According to the initial clinical tests currently being conducted in Finland and Sweden, the new composite material exhibits excellent compatibility with the human body. While the polymers are completely dissolved by enzymes over the course of one to five years, hydroxylapatite, which also occurs naturally in human bone, can be stored entirely in the bones, as one of the body's own substances, without any problems. Thus, a second operation for removal of the implant is rendered unnecessary. Up to now, follow-up operations for the removal of metallic implants, especially in the case of younger patients, have been an everyday occurrence in medicine.

"In surgery, the development of biodegradable and tissue-friendly biomaterials has, for decades, represented a pipe dream," Tormala stressed. These biomaterials were to support living tissue during the interval required for healing and would themselves dissolve without engendering local tissue reactions.

The first polymer biomaterials were developed in the fifties and sixties. On the basis of these substances, the first synthetic, self-dissolving polymer wound closures came on to the market in the seventies. On the other hand, the development of biodegradable setting instruments for healing bone fractures, i.e., pins, screws and plates, proved to be considerably more difficult.

For the first time, in the late seventies, as one of the world's premiere research groups, Tormala and surgeon Pentti Rokkanen used biodegradable composite materials for setting bone fractures. These materials have an initial strength, comparable to steel, which diminishes in tissue over a period of from one to 12 months. "In the meantime, we can purposefully adjust the tensile strength and the duration of the decomposition," added Tormala. Both values are functions of the molecular weight of the polymer matrix.

New clinical trials are currently in preparation (in collaboration with the university clinic in Munich). As a matter of priority, these series of trials should sound out new fields of application. Apart from the areas of pediatric surgery, plastic surgery and cosmetic facial surgery, dentistry and urology are classified as especially promising fields.

'Uncertainty' Prevails in Eastern German R&D

92MI0032 Duesseldorf HANDELSBLATT in German 17 Oct 91 p 30

[Text] Biotechnology rated high in the former GDR. Thousands of scientists carried out research work, primarily at the Academy of Sciences and the universities of Leipzig, Dresden, Jena, Griefswald, Rostock, and Berlin. Their laboratory apparatus was often simple and self-assembled—their foreign currency rarely stretched to modern western equipment—but they achieved striking successes. Scientists from the former GDR were close behind the leading Japanese producers of biosensors.

But the east Germans were successful in other fields as well. Their bacteria-based methods of soil reclamation won acclaim in the West even before unification. In addition to this, they also operated what are probably the world's two biggest bioreactors at the former Schwedt Petrochemical Combine, located north-east of Berlin near the Polish border. Its two tanks each stored 2.2 million liters of diesel oil winterized by a special culture of yeast cells. The yeast transformed the paraffin content of the diesel oil into high- quality proteins for use as animal feed. The plant was closed down for reasons of cost.

The End of the Old Research Structures

The end of the GDR also marked the end of its old biotechnology research structures but its accumulation of know-how often provided the basis for a new start. Seventeen eastern German companies have applied for exhibition space at Biotechnica, which will be held in Hannover from 22 to 24 October. Applicants include nine new companies that have branched out from the old research scene to form new commercial ventures. The basic challenge they face is to convert scientific know-how into marketable products, which is a problem for western German researchers as well.

Some devices that use biosensors have already been field-tested, such as biosensor-equipped analysis systems that can measure blood sugar faster than conventional methods. The biosensor consists of a cellulose membrane on which a very thin enzyme layer is fixed. The method for bonding the enzymes to the membrane is the scientists' secret. They have developed a special polyurethane-based adhesive that fixes the enzyme securely without affecting its properties.

Biosensor for Monitoring Blood Sugar

The enzyme which is also produced by the human body, triggers the conversion of glucose into gluconic acid. This process consumes oxygen. The sensor records the oxygen consumption and converts it into a measurable electric signal. The membrane is of such high quality that it can be used for up to 5,000 measurements.

Last year, the BMFT [Federal Ministry of Research and Technology] launched a special funding program with a view toward safeguarding and expanding eastern German scientific potential. Over 650 projects were submitted for funding, 80 percent by university research institutes and 20 percent by industry. The 200 projects declared eligible for funding received a total of 17 million German marks in grants.

Despite the BMFT's efforts, uncertainly still prevails among the employees of the eastern German institutes. The restructuring process under way in the research sector in the new laender has left many questions unanswered. Many scientists do not know whether they will still have jobs next year. Professor Frieder Scheller, head of the enzymology division at the Central Institute of Molecular Biology in Berlin-Buch, a department that has won international recognition for its developemnt of biosensors, comments, "We have no prospects at all for the time being. We still do not know whether and in what form we can continue our work. This is the reason why over a third of my staff has moved to western Germany. Others will follow suit."

All this greatly jeopardizes the capability of a research team, because the departure of a colleague deprives the group of some of its expertise. The Berlin case is not isolated. The situation is even worse for a team at the Institute of Biotechnology in Leipzig that has been working primarily on developing biosensors for fermentation control and environmental problems. Despite the strong need for new measuring techniques to detect and control pollutants, the institute will be closed by the year's end. According to a committee of experts, the institute is not in line with the research structure of post-unification Germany.

In the opinion of Dr. Dernd Gruendig, who has headed the sensor technology department for a year, this decision is totally incomprehensible, particularly in view of the fact that his laboratory has been recently equipped with new technical apparatus bought with BMFT funds. Spurred on by this new equipment, the department has developed additional research concepts and planned joint projects with industry.

Progress has been made in the biosensor sector too, as the Biotechnica exhibit is designed to show. "Now that our institute has become even more efficient, they want to close it down." Dr. Gruendig and his assistants can only hope that at the last moment politicians will realize that the productivity of institutes in the former GDR should be assessed according to different criteria.

Germany: Silicon Technology Applied to Biotechnology

92MI0045 Duesseldorf HANDELSBLATT in German 23 Oct 91 p 26

[Article by Franz Miller of the Fraunhofer Society: "Cells Isolated in Silicon Rotation Chambers"; first paragraph is HANDELSBLATT introduction]

[Excerpt] Biological cells can be identified and described, and their state of life diagnosed from the way they rotate. Microengineers have constructed a minute silicon laboratory in which biotechnologists can study them, and this interdisciplinary collaboration has also led to the discovery of a new principle for micromotors and micropumps.[passage omitted]

The successful collaboration of two research areas that could hardly have less in common—biotechnology and silicon technology—has pointed the way in completely new directions. The first signs of success in attempts to integrate technical and biological structures in semiconductor chip technology have previously come almost exclusively from Japanese research laboratories.

It was in Berlin, where integration is currently very much on the agenda, that this scientific union started, bringing down the barriers between disciplines. The Berlin Wall had only just been breached when scientists from the biology department at east Berlin's Humboldt University began knocking on the door of west Berlin's Fraunhofer Institute of Microstructure Engineering. The biophysicists had reached the limits of their technical facilities in their reaserch into biological cells; so they turned to the microengineers to create new precision tools to fit the minute dimensions of cells.

Microsystems engineers Dr. Wolfgang Benecke and Dr. Bernd Wagner were quick to appreciate the process's potential, and brief preliminary discussions soon led to intensive collaboration that was to open up unforeseen prospects for both disciplines: a silicon- based microlaboratory with a wealth of applications for the biotechnologists, and new principles for sensors, motors, and pumps for the microengineers.

Cell biologists make increasing use of individual plant or animal cells in water-based solutions for manipulation, and characterization purposes or as test systems. The measurements of these objects typically range from five to 300 micrometers in size, and they are thus comparable in size with the microstructures of integrated semiconductor components. The team working at the Berlin Fraunhofer Institute of Microstructure Engineering has acquired many years' experience in developing new advanced methods of microstructuring silicon. These skills rapidly enabled them to translate the wishes of the Humboldt University's biologists into silicon structures.

Electric Field Forces Manipulate Cells

The first target for collaboration was the systematic optimization and extension of dielectric single cell spectroscopy so different planar microstructured electrode

configurations were produced on glass wafers and oxidized silicon wafers. Suitably etched layers were used to construct measurement chambers [Messkammer raeume], on a base of pure silicon, providing biophysicists with precise electric field cages for confining, characterizing, and manipulating cells.

A second major base was created in the elegant, nondestructive movement of the cells. When high frequency fields migrate over a row of electrodes, cells can be moved linearly. In these minute dimensions the forces have such a great effect that the cells can be reliably and precisely transported to predetermined points and fixed there.

This technique even makes it possible to keep living cells suspensed freely in the hydrous solution. Under the microscope a pollen cell can be observed as it is raised above the electrode's surface and moves in free suspension above the electrodes. Such linear movement is the ideal solution for cell transport in microsystems, and this principle also lends itself for separating cell and particle mixtures. Selected cells can thus be paired, fused, and removed.

This kind of cell manipulation is new, and is expected to turn rotation chambers into complete microlaboratories for cells. The microscope reveals a fascinating world of the future, where cell clusters begin to separate, cells move in different directions, migrate to specific points and join together, while others begin to rotate: This remarkably lifelike scene resembles an automated biological factory in miniature.

The precise grip of these new silicon tools could help biotechnologists to tackle a thorny problem: Dr. Guenter Fuhr believes that in the future, "Cell monitoring will become as important as component testing in microelectronics." The Berlin researchers are already looking at the possibility of measurement chambers with integrated reservoirs and transport channels. Measurement chambers, control electronics, and test objects will be combined to form an integrated microsystem that can be operated with conventional laboratory microscopes and provide wide access to dielectric cell spectroscopy methods.

The investigation of the effects of drugs on the membrane systems of living cells will be the first application. Microtest systems of this type can be utilized in pharmacy for lengthy studies of new combinations of substances, thus helping to avoid tests on animals. Special attention will be paid to anesthetics, toxins, and other drugs affecting the membrane, and to their effects on the cellular system.

German Research Ministry Funds Biosensor Project

91MI0556 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 12 Sep 91 p 7

[Text] Work on biosensors or biochips gives us reason to hope that there will one day be measuring devices for environmental and health monitoring and protection that are quick, specific, sensitive, cheap, can be read on site, and can be used by the layman. In order to accelerate the very risky conversion of these research findings into marketable products, the Federal Ministry for Research and Technology (BMFT) is funding joint projects between research establishments and industry in the biosensor technology section of its Biotechnology 2000 funding program.

One such joint project, "Immune Sensors for the Gas Phase," has recently been approved with total funding of 2.4 million German marks [DM]. Model sensors for the measurement of air contamination at the workplace and in the environment are to be developed by project leader Dragerwerk AG of Luebeck in conjuction with two scientific institutions (Luebeck University and the Borstel Research Institute). A plant protective and a bacterium have been selected as the standard substances to be measured.

The new sensors are to use the same reaction principle as is applied in clinical tests: the antigen-antibody (AG-AB) reaction. In this reaction the harmful substance to be measured, the antigen, is detected by means of the reagent, the antibody.

Unlike chemical reactions, which are generally able to detect only a part of a harmful substance, the AG-AB is highly specific because the antibody recognizes the three-dimensional structure of the material.

The researchers are aiming for a sensitivity in the ppb [parts per billion] range. Detection of 1 ppb of a harmful substance means that one molecule of the substance is still detected amid 1 billion other molecules. The maximum sensitivity achievable depends on the manner in which the AG-AB is performed. Amplifying this reaction by means of a second biological reaction, which is an enzymatic detection reaction, makes a further contribution to high sensitivity.

The enzymatic detection reaction will be conducted in such a way that as the quantity of the harmful substance increases, an increasing quantity of colorant is formed. In this way it is possible to read off the concentration of the harmful material against a color test strip. Since no additional instruments are required for this kind of analysis, the measurement can be made cheaply and directly on the spot.

Apart from the scientific problems, there are also practical problems to be solved. For example, the harmful substance in the air sample must be completely reduced to the sensor's aqueous phase, since the biological antigen-antibody reaction takes place only in aqueous solution. If such sensors are to be used by the man in the street, the steps followed in the laboratory must be greatly simplified and their number reduced to a minimum.

If development of the two model sensors planned proves successful, an important step forward will have been

made towards the general use of biological sensors to detect environmental poisons.

Further information may be obtained from the Biology-Energy-Ecology Project Manager, KFA Juelich Gmbh, P.O. Box 19 13, 5170 Juelich, Tel: 02461/61-5543.

Germany: Biosensor Applications Reviewed

92MI0046 Duesseldorf HANDELSBLATT in German 23 Oct 91 p 24

[Text] Mother nature is godfather to biosensors. In the same way as odors interact with sensitive biological structures in the nose to trigger an electrical stimulus that can be processed in the brain, a biosensor has a transducer—a transformer that relays an electrical signal on contact with the sample.

The transducer has enzymes incorporated into it: amino acid proteins that react with the substance to be identified. The resulting temperature or color effects are converted into the electrical signal, which is then read by the on-line electronic system.

At September's general meeting of the Society of German Chemists (GDCh) in Munich, Professor Otto S. Wolfbeis of the University of Graz revealed details of a new biosensor development achieved by his Institute of Organic Chemistry, the "cholesterol optrode."

Biochemical Sensors at the End of an Optical Fiber

Optrodes (or optodes) have a biochemical sensor connected via a membrane to the end of an optical fiber. Light transmitted [along the fiber] modifies its running properties when something occurs in the "working chemistry" as a result interaction with the substance sought.

These readings could be carried out "on the spot," for example in the bloodstream itself or in a biotechnological process reactor. Optodes resemble electrodes, except that no problems are created by reference electrodes, isolation, and sensitivity to external electromagnetic interference. Optode sensors can be smaller than electrode sensors, and are highly biocompatible.

A high concentration of cholesterol in the bloodstream indicates susceptibility to arteriosclerosis and, consequently, heart disease. The enzyme used in Wolfbeis' optode is cholesterol oxidase. It is covalently bonded to a nylon membrane, where it catalyzes the reaction of cholesterol with oxygen. The consumption of oxygen is measured via an optical fiber in terms of the alteration in fluorescence of an oxygen-sensitive dye, which is dissolved in an ultrathin silicon membrane contiguous with the enzyme layer.

One-Way Biosensors Determine Insulin Requirements

Convenient biosensors with conventional electrodes are already in everyday use in medicine, for example for diabetics. The diabetic just deposits a small amount of blood on the biosensors, which measures the glucose content, from which insulin requirement can then be determined. However, these one-way measuring devices are not, strictly speaking, real biosensors, which are designed for repeated, continuous, and reversible physical or chemical parameter measurements in a mixture of substances.

Imminent applications are seen primarily in the environmental sector and biotechnological process control. One example is an environmental biosensor already developed by Biosens of Hildesheim with Federal Ministry of Research and Technology funding and ready for series production, which uses single-cell algae to monitor water. Harmful chemicals block the light-processing chlorophyll system of the algae, and this is shown by an increase in fluorescence.

Luciferase, "the bringer of light," is the enzyme being used by researchers from the Society for Biotechnological Research (GBF) in Braunschweig, the Ruhr University in Bochum, and the Max Planck Institute of Biochemistry in Martinsried near Munich, in a jointly developed biosensor that reacts to herbicides. As reported at the GDCh general meeting, luciferase combines with herbicide to form a complex that emits measurable fluorescent light during the decomposition that it is designed to undergo.

The Fraunhofer Institute of Solid State Technology (IFT) in Munich uses a field-effect transistor (FET) in transducers in biosensor models. Chemical reactions in the enzyme membrane create charge carriers and cause a measurable voltage over the FET "gate" below. The concentration of the substance sought, such as urea or glucose, can be accurately measured by calibrating this voltage.

Biosensor FET's could thus also be used for process control in bioreactors, though their durability still falls far short of requirements for long-term industrial use. There would also be the danger of contamination, as no germs must be allowed to enter the bioreactor via the biosensor. It is normally not possible to sterilize the biosensor with steam, as is the normal practice with biotechnological equipment, as heat destroys enzyme structures. Nevertheless, the IFT scientists do believe the problems of sterilization can be overcome.

Generally, biosensors represent far more than a "back to nature" tendency; like a dog's nose, they can selectively sniff out the slightest quantity of a chemical substance mixed with others, which gives biosensors technological and economic advantages.

The world market for biosensors is currently estimated at over $50 million; a meteoric expansion during the 1990's, probably at the expense of other methods, is predicted by the market research institutes Frost & Sullivan and Prognos. The total analysis market is estimated at $20 billion per year.

Ciba Geigy's Biotechnology Research, Production Described

92MI0029 Milan NOTIZIARIO CHIMICO FARMACEUTICO in Italian Sep 91 p 61

[Excerpts] [Passage omitted]

Biotechnology at Ciba Geigy

Ciba Geigy began to manufacture considerable quantities of antibiotics and steroids using biotechnological processes at its Torre Annunziata plant back in the midfifties.

This production rapidly expanded in later years on the basis of research carried out at the biotechnology R&D department at Torre Annunziata in close collaboration with the parent company's research laboratories and with the most advanced biotechnology research laboratories in the world. New generations of products therefore came into being on an industrial scale, such as Celospor, Rimactane, and Desferal which remains the only medication for thalassemia.

Selective and stereospecific biotransformation were also introduced into typically chemical production processes for the production of steroids with a large market value. Among these steroids were prednisolone and fluorohydrocortisone used as intermediates for the active ingredients contained in the anti-inflammatory agent Locorten.

Today Ciba Geigy considers biotechnology the third mainstay of pharmaceutical research, on a par with chemistry or biology.

Ciba Geigy's biotechnology research and development is carried out either at company headquarters in Basel or at the pharmaceutical-biotechnology site at Torre Annunziata.

Research is carried out both in the field of fermentation and bioconversion, generally defined the "traditional" biotechnologies. In the field of "new" biotechnologies, these biotechnologies work alongside or form part of the traditional recombinant DNA and genetic engineering techniques.

Biotechnology has had its own research building in Basel since 1983, which is equipped with state-of-the-art laboratories, and pilot plants for the fermentation, isolation, and identification of substances from various cell cultures. The research being conducted in Basel concerns new biotechnologies for the experimental production of some kinds of interferon, a protease retarder like Eglina-C, and tissue plasminogen activators or anticlotting agents such as TPA, and gammaglobulins.

Research and development at Torre Annunziata is carried out primarily in the field of traditional biotechnology and its possible new applications mainly in the field of secondary metabolites, substances produced through fermentation using wild strains that are purified and developed at the Torre laboratories. The latest research has led to the production of antibiotics such as Sorangcin, Strobilurin, and anti-cancer substances such as Saframicin at a pilot plant.

The fields of application for secondary metabolites are extremely wide ranging and varied: from pharmacology to the veterinary and agrochemical fields.

The possibility of improving a fermentation production process is practically limitless although it requires very difficult and costly R&D work, both in terms of scientific and technological know-how, as well as laboratories and pilot plants which must be constantly expanded and renewed.

The staff at Torre acquire know-how through constant applied studies and continued scientific and technological updating, and by activating and promoting all possible synergies with scientific cultural centers in the sectors such as universities and international research centers.

Following the modernization of the fermentation and chemical pilot plants, which were completely restructured with advanced automated systems and machinery operating in accordance with plant safety regulations, Ciba Geigy is asserting its commitment and desire to innovate and expand its traditional biotechnology in southern Italy by inaugurating the new Biotech R&D laboratory at the Torre Annunziata site. These new laboratories will be equipped with the most modern, sophisticated equipment needed for the biotechnology of secondary metabolites, to carry out extremely advanced research and development in the field of microbiology, chemistry, analytical purification technologies on a preproduction level.

Ciba Geigy is using biotechnology in its work in the field of inflammatory, heart, and circulatory diseases, contagious diseases, cancer, metabollic disorders, and allergies.

Many metabolites placed on the market have been the result of research done at Ciba laboratories. In addition, great attention has always been paid to the biological activity of the various compounds that can be obtained from microorganisms and the definite ability to improve their effectiveness through structural modifications.

Ciba Geigy's strategy has always been to study a wide range of new compounds principally for products used in the pharmaceutical sector.

Over the last 10 years, at least 30 new molecules have been discovered and tested. Conditions for their production were developed both in the laboratory and later on a pilot scale in order to obtain sufficient quantities for further testing prior to final applications testing.

The introduction of these substances into standard therapy is likely to create some problems. To be effective, they must be present in the right organ, at the right time, and in the right quantity. Formulas and doses also need to be provided and their development takes long periods of time and a great deal of experimentation.

All of these substances are protected by patents, and some have been applied in some specific fields of use,

thus becoming substances to develop for later industrial production, mainly in the fields of anti-cancer, anti-viral, and anti-inflammatory drugs.

Italy: Biotechnology Association's Report Summarized

91MI0549 Turin MEDIA DUEMILA in Italian Sep 91 pp 112-119

[Article by Giorgio Rivieccio: "We Will Be Cured by Biotechnology Discoveries"]

[Excerpts] [Passage omitted] As with many other frontier technologies, Italy has an enormous potential in the area of biotechnology, with state-of-the-art scientific and industrial skills. However, as always, it is penalized by inadequate funding for research, lack of cooperation between universities, laboratories, and industries, and a lack of incentives that would enable us to compete on a par with our American, Japanese, and European competitors. [passage omitted]

Assobiotec Report on Biotechnology

However, research activities are not confined to laboratories: Around 100 biotechnology products are already being marketed in the United States and some in Italy. In 1990, the overall revenues generated by the eight therapeutic products manufactured using biotechnology totaled $2.71 billion, while sales of biotechnology probes totaled approximately $200 million, a figure that is expected to reach $1 billion by 1995.

The prospects for growth are therefore enormous and comparable to those experienced by the computer science sector in the 1970's and 1980's when manufacturers would report a bad year if revenues increased by less than 20-25 percent.

Biotechnology has drawn the research and industrial worlds into a whirlpool. At present approximately 2,500 biotechnology industries operate in the world, of which some 1,600 are in the United States.

Although Italy can boast an extremely advanced and sophisticated research sector, there are only 150 biotechnology companies in this country, of which more than 50 percent are very small, with fewer than 10 employees.

A report recently published by Assobiotec, the Federchimica [National Federation of the Chemical Industry] association which groups the companies working in this sector, has now provided a detailed picture of the Italian situation: Assobiotec's evaluation of biotechnology in Italy was coordinated by Celestino Spalla, a specialist researcher and writer in this field.

According to the Assobiotec report, in 1989, biotechnology generated revenues of 250 billion lire in Italy, with good prospects for growth. Sales are expected to reach 2.1 trillion lire in 1995 and 4.2 trillion by the year 2000. As in other countries, medical biotechnology products account for 50 percent of the Italian market.

R&D expenditure in Italy is certainly not encouraging: 140 billion lire in 1990, and another 50 billion spent on participation in foreign biotechnology companies. Public research totaled 290 billion lire, primarily through the funding of companies within the framework of the National Advanced Biotechnology Program. As noted in the report, the program received only 209 billion lire in funding compared to the 400 billion previously planned, which demonstrates how government agencies support the sector.

Assobiotec reports that: "Even in Italy, the policy of medium- and large-scale industries is to engage in takeovers, joint efforts, primarily with American research companies, and with Italian and foreign public research groups. The prevailing trend is to purchase research results on the market, usually laboratory research, and then develop processes and products for industrialization in in-house laboratories and industrial plants."

The Italian Situation: Strengths and Weaknesses

However, Assobiotec reports, "Although Italy lags well behind other countries, particularly the United States and Japan, Italian industry is competitive in certain areas (especially the biomedical sector), has well-defined market objectives, and is supported by an adequate level of scientific know-how."

"Briefly," the Assobiotec report reads, "an examination of the biotechnology industry in the leading countries in the 1980's shows that this industry has passed the introductory stage and is currently entering, or has already entered, the development stage. Although the data collected and analyzed shows a situation similar to that of other countries, it has highlighted that the strong points are accompanied by some major shortcomings which, if not rapidly overcome, will severely limit or even prevent Italy from taking full advantage of the enormous potential offered by biotechnology."

These shortcomings include inadequate R&D investments, inadequate training of personnel both in terms of quality and quantity, a significant need for science parks and facilities for technology transfer, the lack of precise standards, a lack of incentives for high-risk investments, difficult ties between universities and industry, and nonexistent coordination by government bodies.

The Assobiotec report concludes with a series of recommendations to the public administration and to industries to enable them to "jump on the bandwagon." Otherwise, Italy risks remaining stranded, as was unfortunately the case with numerous other sectors of technological innovation over the last decades.

One of Assobiotec's recommendations to the public administration is to develop a strategic biotechnology program involving the various government departments in specific but integrated initiatives, a plan for technical and university training, a policy to support the establishment of science and technology parks, facilitate cooperation betweeen universities and industry, bring national legislation into line with EC directives, support high-risk

investments in advanced biotechnolgy with tax rebates, and provide insurance and financial incentives.

Recommendations to companies include the need to invest more heavily in medium and long-term R&D programs, better utilization of the results of university, CNR [National Research Council], and public agency research, greater confidence in universities, and greater efforts to develop biotechnology not only in the pharmaceutical sector, but also in the agricultural, food, and environmental areas, which appear to have great potential and development prospects in our country.

Number of Science Parks and Participating Biotechnology Companies

Science Parks Established in the Major Industrialized Countries and Biotechnology Companies Established as of 1988 (From a Sample of 20 Science Parks)

Country	Science Parks	New Biotechnology Companies	Percentage of Companies Operating in the Parks Compared to the Total Number of Biotechnology Companies
United Kingdom	42	70	50
Germany	32	15	30
France	26	32	30
United States	25	100	20
Japan	20	Not available	Not available
Benelux	11	10	35
Italy	2	3	Not significant

Sources: FINANCIAL TIMES, United Kingdom Science Parks, Assobiotec, International Association of Science Parks, "Economics of Technology Change," various press articles

National Advanced Biotechnology Programs: Research Topics, Costs, Duration, Participants

Topic number	Description	Duration, in months	Cost in millions of lire	Participant
1	Monoclonal antibodies for use in diagnostics	48	7,000	Tecnogen, Pomezia
2	Nucleic acid probes	60	7,155	Biotechnology Consortium, Brescia
3	Characterization and separation technologies for plasma proteins	60	16,000	Siena Research Consortium, Siena
4	DNA-modified fibrinolytic enzymes	60	10,440	Farmitalia Carlo Erba, Milan
5	Technologies for the synthesis and post-transductional modification of pharmacological polypeptides	60	15,130	Tecnogen, Pomezia
6	Monoclonal antibodies for immunotherapy	60	13,000	Tecnogen, Pomezia
7	Immunotoxins and other conjugates for therapeutic use	60	9,150	Sudbiotec, Pomezia
8	Biologically active microbial metabolites	60	11,000	Farmitalia Carlo Erba, Milan
9	Enzymes with new properties	60	13,000	Tecnofarmaci, Pomezia
10	Bioconversion and enzymatic catalysis for the production of intermediates and/or fine chemistry products	60	15,615	Guido Donegani Institute, Novara
11	Polysaccharides from natural sources	60	14,493	Fidia, Abano Terme
12	Biodegradation of sludge and oil residues generated by the petroleum and petrochemical industries	60	5,794	Eniricerche, Milan
13	Biological treatment of effluents generated by the dairy industry	48	5,000	Consorzio Bioprogram, Ravenna
14	In vitro regeneration of plants from protoplasts and cells	60	8,170	Agrimont, Milan
15	Introduction and expression of exogenous genes in plants	60	7,620	Agrimont, Milan

National Advanced Biotechnology Programs: Research Topics, Costs, Duration, Participants (Continued)

Topic number	Description	Duration, in months	Cost in millions of lire	Participant
16	Nitrogenous metabolism of extensively cultivated plants	60	13,067	Enichem Agricoltura, Palermo
17	Enzymes for the food industry	60	9,702	Enichem Synthesis, Palermo
18	Technologies to assess food safety	36	5,000	Cremascoli, Milan
19	Technologies to assess food freshness	36	3,000	Cremascoli, Milan
Overall expenditure on research activities		Not available	189,338	
Expenditure on professional training			19,662	
Total			209,000	

Source: GAZZETTA UFFICIALE

Summary of Biotechnology in Italy

Industry	Figures
Companies	
— New biotechnology companies	57
— Large companies with biotechnology activities	77
— Total	134 (1989)
Employees	
— New biotechnology companies	470
— Large companies with biotechnology activities	1,550
— Total	2,020 (1989)
— R&D expenditures	140 billion lire
— Biotechnlogy revenues	250 billion lire
— Market for biotechnology products	400 billion lire (1989)
— Biotechnology investments	315 billion lire (April, 1989)
Public sector	**Figures (1989)**
R&D (employees)	
— Biotechnology employees in universities	3,500
— Biotechnology employees in research centers	900
— Total	4,400
R&D (expenditure)	
— University, CNR [National Research Council], and other research centers	230 billion lire
— Research investment by companies	60 billion lire
— Total	290 billion lire
Training	
— Degree programs in biotechnology	1
— Post-graduate colleges	10
Infrastructures	
— Science parks	2

Note: The figures on industry were collected and drawn up by Assobiotec. The number of people working on R&D in the public sector was obtained by analyzing the work of staff on targeted projects and random interviews. R&D costs, both for the public and private sectors, include personnel costs.

Source: ISTAT [Central Statistics Institute], MURST [Ministry of Universities and Scientific and Technological Research], Assobiotec.

COMPUTERS

SGS-Thomson Launches Fuzzy Logic Research Program

91AN0554 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 5 Sep 91 p 10

[Article by Francoise Grosvalet: "SGS-Thomson Invests in Fuzzy Logic"]

[Text] The French-Italian firm is about to commit $30 million over five years to a technology which is practically the exclusive reserve of the Japanese.

Fuzzy logic is attracting more and more followers. After the United States and Japan, it is now Europe's turn to delve into this new market which could revolutionize the design of future electronic systems. The first to date is SGS-Thomson, which has just launched a five-year research program for the development of fuzzy components. The French-Italian firm will set aside $30 million for the project, which should enable it to develop processors and microcontrollers capable of processing fuzzy logic rules. The company is seeking partners for the software. Siemens also seems interested in fuzzy logic, as do a certain number of European suppliers, especially in the automobile sector.

American in origin, the concept of fuzzy logic—different from binary logic in that it allows the full diversity of the real world to be taken into account—has up until now been put to best use by the Japanese. They have already implemented fuzzy circuits in consumer electronics equipment and computers. So far, it has been exclusive to smaller companies—the Togai Infra Logic company was the first to introduce an 8-bit microprocessor dedicated to fuzzy logic in 1989—but fuzzy logic increasingly interests major semiconductor manufacturers. Thus, NEC has just signed an agreement with Omron (see box) which works the patents of a small American company called Apt Instruments; Fujitsu has also introduced its first fuzzy logic microprocessor.

Dedicated Controllers in Line of Sight

According to Gianguido Rizotto, head of the fuzzy logic program at SGS-Thomson, fuzzy processors could take a large share of the future dedicated controller market. He also forecasts that sales of semiconductors in this field could reach $1 billion around 1995. The French-Italian firm's first fuzzy circuits should be available by the end of next year. SGS-Thomson is following two different courses. For top-of-the range applications, like workstations and expert systems, it is developing a specific coprocessor to operate fuzzy logic software. For industrial use and for the general public, the firm is developing two kinds of dedicated processors which should have a complexity equivalent to that of the current 4-bit microcontrollers but with the performance of a 16-bit device.

[Box]

NEC [Nippon Electric Company] and Omron Team Up

The agreement which has just been signed by NEC and Omron involves the joint development of software development tools and microprocessors for fuzzy logic systems. According to the terms of this agreement, NEC will develop and market 4-, 8-, and 16-bit microprocessors based on the patents and technical information provided by Omron. Omron will develop the compilers. The aim of the two companies is to standardize the software terminology to enable the development of applications in fuzzy logic in an open environment.

Netherlands Installs NEC SX-3 Supercomputer

92AN0001 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 26 Sep 91 p 10

[Article: "New Supercomputer gives NLR Some More Headroom"]

[Text] About three and one-half years after its first supercomputer was installed, the National Air and Space Laboratory (NLR) has exchanged it for a next-generation model. The most powerful supercomputer in Europe officially went into service last week in the North East Polder.

The new supercomputer, the NEC SX-3, is the successor to the NEC SX-2. With a speed of 2.75 gigaflops (2.75 billion computations per second), it is one of the most powerful computers in the world. Its speed will be doubled within a few months by the addition of a second processor. It is capable of further extension up to 22 gigaflops so that for the time being the NLR will be able to continue its research into new aircraft shapes and spacecraft.

NLR's principal motivation for the acquisition of a supercomputer costing several tens of millions of guilders is the calculation of airflow around aircraft. These calculations are extremely important for the development of new aircraft models. The supercomputer will also be used for the calculation of the strengths required for new aircraft and in satellite construction.

Wind Tunnel

Originally questions concerning the strength of a construction and the turbulence around an aircraft could only be solved through conducting experiments. These needed a great length of time for preparation. For instance, it takes about one year to make an accurate aircraft model suitable for wind tunnel testing. It is also possible to simulate aircraft behavior by use of a computer and specific software. Due to their complexity and the large number of calculations that must be made, only the most powerful computer is suitable. The NEC SX-3, which the NLR can now consult, is indeed one of the most powerful supercomputers in the world, but researchers are still coming up against limitations. They are now at the upper limit of the potential for aircraft calculations, but these still give only approximations. In

order to calculate the characteristics which occur in reality, still faster computers are needed, according to Eng. W. Loeve from NLR's Computer Department.

Another major user for the supercomputer is the Expertise Center for Computer Simulations of Fluid Mechanics. Together with the Hydrodynamic Laboratory, the University of Twente, and the Technical University of Delft, the NLR is working through this center on the development of a general information system for fluid calculations, known as ISNAS. This not only concerns the flow of air around aircraft, but also around ships, motor vehicles, and water works. Calculations concerning the water currents during the closing of the flood barriers in the East Scheldt are, for instance, made on the supercomputer in the North East Polder.

Market

Originally, the NLR was the first institute in Europe to throw in its lot with a Japanese manufacturer for the purchase of a supercomputer. Since then, NEC has been able to evaluate the European market and has reached the conclusion that it should be possible to sell 20 supercomputers in Europe in the period up through 1994. This involves an investment of between 10 and 40 million guilders each. In addition to the NLR, there are at the moment two more orders. NEC is also going to place a supercomputer in the University of Cologne, and another one in the computer center used by collaborating universities in Switzerland.

Worldwide there are 17 outstanding orders, of which 12 are in Japan itself.

DEFENSE R&D

Thomson, Aerospatiale, MBB Develop VT1 Missile

91AN0569 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 12 Sep 91 p 10

[Article by Philippe Le Coeur: "Missiles: Thomson-CSF Teams Up With Aerospatiale and MBB"]

[Text] Aerospatiale and MBB will manufacture Thomson-CSF's VT1 missile in Europe.

Yesterday's bitter rivals are today's partners. Thomson-CSF, Aerospatiale, and MBB are burying the hatchet and entering into unprecedented cooperation in the field of short-range ground-to-air missiles.

According to an agreement announced last week, Alain Gomez' firm [Thomson-CSF] is going to entrust the production of its VT1 missile to Euromissile, the economic interest grouping of which Aerospatiale and MBB have been members for nearly 20 years. Manufactured until now in the United States by LTV, the VT1 missile is designed for Thomson-CSF's Crotale antiaircraft systems. It will now be used to modernize Euromissile's Roland systems.

For Thomson-CSF, this agreement has arrived just at the right moment. Europe's leading defense electronics company was making no secret of its intention to transfer production of the VT1 to Europe, after manufacturing an initial batch of 1,000 missiles.

However, a partner still had to be found. British Aerospace was for a long time the likely candidate, to the point that the two firms had considered creating a joint subsidiary—Eurodynamics—before abandoning the idea last spring.

With Euromissile as its partner, Thomson-CSF now has a sizeable market open to it. The Roland systems currently in use throughout the world are equipped with 25,000 missiles, and the Crotales with 6,000 to 7,000 missiles. "We can count on a replacement market of 30,000 missiles, in other words around Fr30 billion," is the estimate of Noel Clavelloux, manager of the Missile Systems branch of Thomson-CSF.

Half As Expensive

This prospect has not been lost on Aerospatiale and MBB, who, a few days before signing the agreement with Thomson-CSF and by lack of a launch customer, had canceled their project for a new hypervelocity missile for the Roland. Known as RM-5 (Roland Mach 5), this self-financed program was to be carried out in cooperation with Matra.

"Manufacturing the VT1 is of course a less noble venture," acknowledges Jean-Louis Fache, manager of Aerospatiale's Tactical Missiles Division. "On the other hand, it gives us the advantage of a new system without the cost of developing one." In fact, instead of the billion francs which the development of the RM-5 would have absorbed, the European version of the VT1 should cost around half as much.

The opportunity to acquire a "guaranteed" workload influenced the choice made by Aerospatiale and MBB as much as the prospect of a considerable market and R&D savings. In this era of shrinking military budgets, it is true that this agreement will come as a breath of fresh air to the French electronics firms in Euromissile, i.e., Mors, Telecommunications Corporation (SAT), and Radioelectric and Telephone Telecommunications Company (TRT). In practice, the production of the VT1 will be shared equally between France and Germany.

It now remains to be seen whether, strengthened by this alliance which gives them control over 60 percent of the world's short-range ground-to-air missile market, the three partners will take the experiment further, for example, to create a European missile giant.

They are denying this at the moment. "Euromissile and Thomson-CSF will not merge their missile activities," assures Noel Clavelloux. "We prefer to build gradually on sound foundations. Perhaps we will go further at a later date."

But for how long will they be able to justify the continuation of two competing air defense systems, which

moreover are equipped with the same missile? The question will become even more glaring if, as is possible, British Aerospace uses the VT1 missile to modernize its Rapier system, a competitor of the Crotale and the Roland.

ENERGY, ENVIRONMENT

Germany: Riesenhuber on Renewable Energy Research

92P60017A Berlin ING DIGEST in German Oct 91 p 14

[First paragraph is ING DIGEST introduction]

[Text] Nowadays we are not so concerned with the limited energy resources as we were in the 1970s. But it is becoming more and more urgent to replace fossil fuels to stop the greenhouse effect and environmental pollution. What can Germany expect from renewable energy sources? ING DIGEST correspondent Dietrich Goerke questioned Federal Minister of Research Dr. Heinz Riesenhuber. Here are his views.

- Renewable energies today have a share of 2.5 percent of the total energy needs; it seems possible to raise this share up to 10 percent. It is a matter on the one hand of the energy supply, on the other hand it concerns the development of techniques so that our industry can master them, optimize them, and offer them to other countries.
- The greatest potential lies in photovoltaics, which is the direct conversion of sunlight into electricity. Here too is the greatest need for development. An almost ideal technology is feasible: a machine with few moving parts, thus hardly subject to breakdowns. But the costs are still too high today at about 2 German marks [DM] per kilowatt-hour, although costs have greatly a dropped in the last 10 years.
- To lower costs means mainly to increase the degree of efficiency. We are already attaining 22.3 percent efficiency for gallium arsenide cells, and about 20.5 percent for silicon, which is the top European laboratory figure. To further increase these figures, we are trying all suggested types of technology and of cells: thin layer or tandem cells, microcrystalized or monocrystalline, or amorphous. Demonstration projects such as those in Kobert-Gondorf or on Pellworm and Fehmarn are significant in this regard. The latter project also furnishes the example of a photovoltaic-wind-biogas installation to supply a purification plant which is to be built near Ribnitz-Damgarten.
- The tiniest applications, such as in pocket calculators or toys, are niches to open up a large market. The larger the size of serial production, the greater the effect is produced. Moreover, the "Solist" solar boat, supported by BMFT, was recently launched. Solar cells supply the silent and environmentally compatible engine. Still this year, 2,250 roofs are to be equipped with solar cells. Each of new laender will get a supply of 150 installations.
- The world market for photovoltaic cells is probably about 30 to 35 MW at this time. That is still not much, but if we can achieve application niches, then the construction of larger installations will become attractive to companies. The BMFT is spending about DM100 million per year in photovoltaic development.
- There are many techniques in geothermal energy. The old laender are mainly investigating the hot dry rock technology, together with the United States. Rocks are broken up by explosives down to 5,000 to 6,000 meters in depth. Water is pumped in the rock, and returns at a temperature of about 180° Celsius and can produce energy in classic generators. But the procedure turns out to be complicated. At present we are organizing a European project, for which sites are being examined in Cornwall/England, Soultz-sous-Forets/France, and Urach/Germany.
- We have spent DM3 million on a study to be done mainly by Geothermie Neubrandenburg GmbH to determine the size of the potential in this area. In the GDR, the strategy was different: small installations (5.7 and 10 MW), temperatures of 90° Celsius, which is enough for heating and water for industrial use. If someone turns up to run these installations, we are ready to help with the financing.
- One can do a lot with wind energy with modern technology. With a budget of DM30 million, we are basically testing all types: with one, two, three and five vanes, with new materials, with the most modern aerodynamics. this technology is being tested in wind parks, sometimes in connection with biogas and photovoltaics. In projects in Ireland or in developing countries we combine them with diesel engines, for example. If there is no wind, there is still energy available, but otherwise one saves diesel fuel.
- The German 100 MW program has already reached 250 MW. Here the BMFT is subsidizing with considerable amounts, and with 10 percentage points more in the new laender than in the old laender. In addition, the feeder compensation for electricity from renewable sources was introduced in 1990. I see good chances that one will reach relatively quickly economic feasibility comparable to electricity from coal. Favorable installations on windy locations are already delivering electricity at 20 pfennig per kilowatt hour. However, the wind must blow, and therefore the number of suitable sites in Germany is limited.
- On the longer term, hydrogen will play an important role in the energy economy. With the DM20 million which we are spending on it in 1991, we lead the world. We are supporting in particular the electrolysis of water, particularly the high temperature electrolysis of steam. We are also attaining very high yields, knowing that this is a long term strategy with which we will use a combination of procedures to emerge from the market niches into the big markets.

- Among crops as raw material for energy, rapeseed oil is the best candidate. Together with mineral oil, one can attain a cheap process in co-refining. There is quite a variety of projects in our ministry on crops as raw materials.
- With their significantly higher efficiency as compared with thermal combustion, fuel cells can transform hydrogen, natural gas and coal gas electrochemically into electricity. This could achieve a considerable reduction in CO_2 in 10 to 15 years. New materials, such as ceramics, open up areas where fuel cells, once almost given up for lost, can be used economically. The high temperature type—the oxide ceramic and the fused carbonate fuel cells—has the most interesting potential.
- Energy storage equipment also has a great future. We have been promoting for 10 years the development of the sodium/sulphur battery. It is already being tested in electric autos and will come into operation in the next few years. The range of battery-powered urban autos is already between 150 and 180 kilometers. The nickel-cadmium battery is also included in our strategy; it offers the chance to attain higher power densities and ranges.
- All the projects should be seen in the context of the ambitious goal of the federal government to reduce CO_2 emissions by 25 to 30 percent by the year 2005.

Soil-Borne Microorganisms Combat Chlorophenol Pollution

92P60013A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 26 Sep 91 p 8

[Text] In the soil, chlorophenols can be broken down by microorganisms. This is the conclusion reached in a study, by the Fresenius Institute, Taunusstein, which was organized within the context of a project of the Federal Minister for Research and Technology. Difficult to break down, chlorophenols are toxic compounds used as herbicides. Both as abandoned polluted areas in intensively farmed soils and as toxic constituents of sewage sludge, chlorophenols pose an environmental problem. The goal of Hans Herrmann Rump and Bernd Scholz, the scientists in charge at the Fresenius Institute, was to address statements relative to the behaviour of chlorophenols in regions of biologically active soils, above the water table. The question as to the ability of soils to purify themselves was one particular issue that stood at the forefront. This is significant if one is to ascertain to what extent chlorophenols from old sediment (sewage sludge, for instance) can lead to ground water contamination.

Here, there are many factors to be considered. These include chlorophenol concentration; the biological, physical and chemical processes taking place in the sediment; the location of the pollution layer; and, the nature of the covering layer. The actual purification capacity of the microorganisms is also dependent upon several factors. These include, among others, temperature and the supply of oxygen and nutrients. Furthermore, depending upon the soil type, chlorophenols are bound with varying degrees of rigidity to objects in the soil. In the study, all these factors had to be taken into account.

The decomposition of chlorophenols was experimentally investigated, among other things, in soil columns and in a ground water model. The detection of products of decomposition and a pollutant balance, ascertained through further study of the soil, served as indicators of the breakdown of the chlorophenols that were added. Products of chlorophenol decomposition could be detected in the soil columns into which various kinds of soil were introduced. Moreover, in collaboration with the Institute for Urban Civil Engineering of the Technical University of Braunschweig, the breakdown of the pollutants was investigated in a simulated refuse dump with an abandoned polluted zone containing chlorophenols. To do this, the scientists mixed chlorophenols with a mixture of crushed refuse and compost and applied a layer, in sealed airtight containers, to a bed of refuse. It was shown that, under these conditions, the chlorophenols added as well as products of their decomposition vanished, for the most part, within 250 days. Allegedly, the agents responsible for this were microorganisms which, when hermetically sealed, break down the pollutants by means of reductive dehalogenation.

Germany: BASF To Increase R&D in Recyclable Materials

92MI0031 Duesseldorf HANDELSBLATT in German 22 Oct 91 p 29

[Text] BASF [Baden Anilin and Soda Factory] Ag of Ludwigshafen has come out in favor of additional funding for basic research on renewable raw materials. "Renewable raw materials are a valuable complement to fossil resources," stated BASF board member Dr. Hans-Juergen Quadbeck- Seeger in the course of a meeting with representatives of the German agriculture ministries. He expressed his concern about the prospect of a cut in the Federal Ministry's funding for renewable raw materials.

According to a 1985 survey by the Chemical Industry Federation, (VCI), some 1.8 million tonnes of renewable raw materials are used by the German chemical industry every year, i.e., around 10 percent of the sector's total consumption of raw materials.

The use of rapeseed oil and methyl ester derived from rapeseed as fuels and the extraction of special fatty acids from coriander are two of the priority areas of the chemical industry's developemnt work. BASF is using linseed oil to produce printing ink in a pilot project.

The company believes that many application for renewable raw materials are not viable in terms of current market prices and are therefore dependent on public

funding. Nevertheless, like the representatives of the laender, it takes a positive view of the long-term prospects offered by these processes.

German Spending on Energy Research Reviewed

91MI0555 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 12 Sep 91 pp 4-6

[Text] Federal Government expenditure in support of energy research and energy technology amounted to some 1.6 billion German marks [DM] in 1990 (provisional figure) and around DM1.8 billion are allocated for that purpose in the 1991 budget. How these amounts are broken down can be seen from the tables below.

Table 1 shows Federal (or Federal Ministry of Research and Technology [BMFT]) expenditure on the promotion of energy research and energy technology, broken down according to the various objectives funded, and particular attention is drawn to the resources allocated to "renewable sources of energy and rational energy use."

About 85 percent of the funds for nuclear power research, including both institutional and project funding, is accounted for by state responsibilities, some of them covered by contract or treaty, for research into reactor safety, R&D work on radioactive waste disposal and treatment in accordance with statutory obligations, the disposal of old nuclear dumps, and maintaining competence in the fields of licensing and radiation protection. Only the remaning 15 percent is earmarked for the development of new, optimized, and safer reactor designs. The marked increase in expenditure for the promotion of "nuclear power research (including reactor safety)" is largely explained by the inclusion of the new Federal Office for Radiation Protection, which was set up in Salzgitter in 1989.

Only the BMFT's project funding can be further divided according to types of energy. These figures are shown in Table 2. This table also shows the resources given by the BMFT to fund institutions working on various programs, as it is impossible to subdivide them or the funds from other ministries.

Table 1. Federal Expenditure in Support of Energy Research and Energy Technology, in DM millions

	1990 Actual			1991 Projected		
Funding program	BMFT	Other ministries[1]	Total	BMFT	Other ministries[2]	Total
E1 Coal and other fossil fuels	151.2	0.6	151.8	146.0	0.6	146.6
E2 Renewable energy sources and rational energy consumption	277.1	0.0	277.1	351.8	0.0	351.8
E3 Nuclear power research (including reactor safety)	678.8	278.5	957.3	572.4	487.3	1,059.7
E4 Nuclear fusion research	198.3	0.0	198.3	206.4	0.0	206.4
E Energy research and energy technology	1,305.4	279.1	1,584.5	1,276.6	487.9	1,764.5

1) Provisional

2) Government draft

Table 2. BMFT Expenditure in Support of Energy Research and Energy Technology According to BMFT R&D Classification Activities, in DM millions

1991 Federal R&D Classification Activity	1990	Projected 1991
E111 Prospecting, extraction, and processing of coal	31.5	23.0
E112 Prospecting, extraction, and processing of other fossil fuels	22.8	9.5
E113 Coal-fired furnace and power station technology	58.8	75.0
E114 Coal hydrogenation	10.1	9.5
E115 Coal gasification	12.4	13.0
E119 Other work on fossil fuels, including work affecting other sectors	5.8	6.0
E1. Totals without major research establishments	141.5	136.0
E1. Major research establishments	9.7	10.0
Totals for funding program E1	151.2	146.0
E211 Photovoltaic	91.9	107.0
E212 Wind energy - project funding	18.1	27.0
E213 Wind energy - indirect specific funding	3.8	7.0
E214 Systems of use for southern climates	34.1	38.0

Table 2. BMFT Expenditure in Support of Energy Research and Energy Technology According to BMFT R&D Classification Activities, in DM millions (Continued)

1991 Federal R&D Classification Activity	1990	Projected 1991
E215 Biological generation, storage, and use of energy	8.5	20.0
E216 Geothermal and other renewable energy activities	14.3	23.0
E221 Electricity and remote heating	10.3	11.0
E222 Energy-saving industrial processes	12.2	14.0
E231 Energy storage	11.2	16.0
E232 Hydrogen	18.1	24.0
E241 Rational energy consumption and use of solar energy	22.1	31.0
E2. Totals without major research establishments	244.5	318.0
E2. Major research establishments	32.6	33.8
Totals for funding program E2	277.1	351.8
E311 Breeder reactors (FBR's)—compact sodium-cooled nuclear reactor plant (KNK II)	—	—
E312 Breeder reactors (FBR)—SNR 300 incl. associated research and development	39.9	38.0
E313 Breeder reactors (FBR)—Further development	26.2	11.0
E314 Breeder reactors (FBR)—Fuel cycle	1.0	—
E321 High-temperature reactors (HTR)—THTR 300	—	—
E322 High-temperature reactors (HTR)—Further development	19.2	17.0
E330 Other reactor development	0.3	0.5
E341 Nuclear fuel supply (other than uranium enrichment)	2.4	2.0
E342 Uranium enrichment	0.6	0.5
E351 Reprocessing and recycling of nuclear fuels: monitoring of fissile material	16.3	8.0
E352 Treatment and conditioning of radioactive waste	6.6	12.4
E361 Permanent disposal of radioactive waste	39.6	30.2
E369 Other work on disposal, including work affecting other sectors	1.0	1.9
E381 Research into reactor safety—light water reactors	37.5	45.0
E382 Research into reactor safety—advanced reactors	15.4	5.0
E383 Research into reactor safety—other work, including work affecting other sectors	80.4	90.3
E390 Risk sharing in nuclear power	60.0	10.0
E3. Totals without major research establishments	374.3	316.8
E3. Major research establishments	304.6	255.6
Totals funding program E3	678.8	572.4
Funding program E4. Nuclear fusion research	198.3	206.4
Major research establishments		
Total E, without major research establishments	760.3	770.8
Total E, major research establishments	545.1	505.9
Grand total	1,305.4	1,276.7

Germany Plans Environmental Research Center

91MI0553 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 12 Sep 91 pp 2-3

[Text] Concrete measures are now being taken for the foundation of the Environmental Research Center in Leipzig/Halle/Bitterfeld, which was proposed as early as the start of 1990. This will be the first major German research institute devoted exclusively to environmental research.

In consultation with the laender of Saxony and Saxony-Anhalt, the Federal Ministry of Research and Technology (BMFT) has appointed a high-ranking foundation committee, which has now begun work. Its brief is to determine the objectives and structure of the new research institute and to assist in the selection of personnel, especially for management positions. The Environmental Research Center is to be operational by 1 January 1992.

In determining the objectives of the Environmental Research Center, the foundation committee is able to

draw on extensive groundwork and recommendations in three areas:

- A joint research project funded by the BMFT since October 1990 on "Ecological Concepts for the Heavily Polluted Region of Leipzig/Halle/Bitterfeld." Around 150 experts from former Academy of Sciences and Academy of Agriculture institutes, the Universities of Leipzig and Halle, industry, and land facilities are currently working on this project.
- The work of the scientific team that the BMFT set up in the spring and which in June 1991 presented a draft plan for the proposed new Environmental Research Center.
- The July 1991 recommendations of the Science Council regarding the formation of an environmental research center in the form of a major research institute, contained in the interim report on environmental research in the new laender.

The new Environmental Research Center will engage in ecological research into how to deal with severe environmental pollution and its effects on human beings and ecosystems.

For the near future, the principal objective will be to arrive at a scientific basis for reclamation programs and related scientific work.

Longer-term tasks concern the understanding of ecological regeneration processes, comparison of the long-term effects of different types of high level pollution, and attempts to transfer the findings to the countries of eastern Europe in particular. Specifically, the Environmental Research Center will, as the joint research project is doing now, concern itself primarily with the following practical aspects:

- Plans for the reclamation of highly polluted industrial ground in the chemical industry belt, recommendations for redevelopenmt, and future use;
- Plans for the use of, and recommendations for action on the redevelopment of mining areas;
- The development of methods for making urban planning in towns and conurbations ecologically sound;
- Ecologically sound plans for agricultural land use, i.e., a return to appropriate agricultural production on black earth;
- Ecologically compatible use of water;
- Concepts for natural ecosystems.

In addition, a study will be made of whether the Environmental Research Center can also carry out scienfific groundwork on product- and production-integrated environmental protection by drawing up ecological balance sheets. It is not intended that the center should develop its own environmental technologies. In this respect, industry in particular is urged to advance the state of the art in cooperation with technical universities.

However, it does seem sensible to include tropospheric research so as to be able to investigate environmental stresses and their effects on the interrelationship between air, soil, and water and how they can be avoided. However, it seems that the present problems of high air pollution will be solved more quickly and are thus of a different order from soil and water pollution. In the long term, the Environmental Research Center will concentrate on polluted soils and how to restore them.

The Environmental Research Center will employ 400 people, about 140 (35 percent) of them scientists. It will only be able to carry out its task, and this is one of the important points in the whole idea behind this major research institute, if it operates in conjunction with universitites and other research establishments. It is intended that contractual arrangements will be entered into with Leipzig and Halle unviersities from the outset.

In Halle-Merseburg there will be potential in the following fields: agronomy, biological sciences, production engineering, geosciences, environmental law, and environmental ethics. Leipzig currently has expertise in urban ecology and analytical chemistry.

Being a major research establishment, the Environmental Research Center will recieve 90 percent of its funding from the BMFT and 10 percent from the two laender of Saxony and Saxony-Anhalt. A contractual agreement to this effect is being prepared. The requirement for 1992 is put at 50 to 60 million German marks.

Germany: Report on Environment Issues in Eastern Laender Reviewed

91MI0573 Wuerzburg UMWELTMAGAZIN in German Aug 91 p 88-89

[Second part, by U. Adler, R.U. Sprenger, and J. Wackerbauer, of Ifo Institute Survey; first paragraph is UMWELTMAGAZIN introduction. Part of this study was presented in the July 91 issue of UMWELTMAGAZIN. Below are extracts from Part 2. of the contribution by U. Adler, R.U. Sprenger and J. Wackerbauer.

[Text] On behalf of the Minister of the Environment, Planning, and Agriculture of the land of North-Rhine Westphalia, at the end of last year the Ifo Institute carried out a study of the environmental situation in the new laender, the investment that this situation necessitates, and possible ways in which North-Rhine Westphalian environmental protection industry could help solve these problems.

Waste Disposal

The situation regarding waste in the GDR was markedly different from that in the old Federal Republic. At 2.9 million tonnes per annum, household waste was lower in relation to overall population. This was the result of both the lower consumption level and the fact that a significant proportion of waste was utilized for heating.

Comparing specific values, the incidence of industrial waste up to 1990 was markedly higher than in the

Federal Republic. The higher incidence of industrial waste was due to outmoded production processes with comparatively higher emission levels.

To offset this problem, and to counter the shortage of raw materials, secondary raw materials were intensively produced. These included not only common items of domestic waste (paper, glass, organic waste), but almost all industrial by-products as well. At 36 million tonnes per annum, 40 percent of industrial waste (91 million tonnes per annum, excluding building waste) was recycled, providing 10 percent of industrial raw materials. Although this is considered a modern strategy, the figures show that only secondary raw materials production reduced the GDR's specific waste incidence to the level of western industry. In the internationalization of the waste problem, industry in the new laender thus lags behind western industry.

Investment Requirement

In assessing the need for investment in waste management, the following assumptions were made:

- The waste management law, with its aims of "reduction, recycling, and avoidance," will take effect;
- The structure of waste incidence will change;
- In the long term, the incidence of waste in the new laender will adjust to the standard of the older laender in extent, composition, and structure, and stabilize at this level. Household refuse will rise to some 4 million tonnes per annum. Waste similar to household refuse will reach 4.3 million tonnes per annum;
- Industrial waste will tend to decrease, since modernization of production may be expected to bring a specific waste reduction;
- Incidence of special waste will remain unchanged;
- The secondary raw material industry will remain at its present level.

Taking these assumptions together and applying them to the individual segments of waste, the following waste incidence emerges:

Household refuse	8.3 million tonnes per annum
Industrial waste	60.0 million tonnes per annum
Building waste	15.0 million tonnes per annum
Special waste	1.3 million tonnes per annum

This structure was taken as a basis for an estimate of the investments required in the waste sector, using average specific investment values. A linear optimization model took account of the dumping, sorting, incineration, and degrading processes, the following three scenarios were computed:

- Dumping as the sole process: investment required: 14.4 billion German marks [DM];
- Average demand on recycling facilities: investment required: DM32 billion;
- Optimum demand on recycling facilities: investment required: DM37 billion.

Taking the various estimates for individual requirements or the overall estimates of the need for investment in ecology in the new laender together, the available information suggests an estimate ranging from a minimum of DM83 billion to 320 or even 500 billion. The estimates produced or adopted by the Ifo Institute amount to an investment requirement of some DM211 billion to the year 2000; this figure includes the improvement of drinking water supplies and noise abatement.

Anticipated Investment Requirements for Environmental Protection in the Former GDR to the Year 2000

Sector	Overall Requirement in DM billions		
	Published Estimates from		Ifo Estimates to
Keeping the air clean	5.0	35.0	22.5[a]
Drinking water supply	16.8	30.0	16.9
Sewage disposal	53.0	150.0	125.2
Waste disposal	3.0	34.3	34.3[b]
Reclamation of polluted sites	3.0	70.0	10.6
Noise abatement	2.0	2.0	2.0[a]
Totals			
Individual estimates covered	82.8	321.3	211.4
Overall estimates	83.0	500.0	

a): Adopted estimates—b): including operating costs

Source: Ifo Institute compilation and estimates

Major Demand Factors

In the final analysis, what gets things moving on the environmental engineering market is actual demand, not just the existance of a need. The first hints as to how a demand of this kind can be developed in the new laender were provided by a survey of eastern and western German environment technology suppliers, in which

recent environmental protection legislation and its implementation were most frequently cited as the major factors determining demand.

The financial situation of the district corporations in the new laender and the state of the economy there were also considered important factors determining demand.

Suppliers from North-Rhine Westphalia are primarily interested in selling their products in eastern Germany, through subsidiaries, cooperation agreements, and joint ventures could gain increasing importance in the future. A previous survey of North-Rhine Westphalian suppliers of environmental protection goods and services revealed that firms working in this market react flexibly to new forms of demand.

Surveys of eastern and western German firms reveal a high degree of willingness to work together. Although such cooperation agreements currently tend to concentrate on mutual supplies, a trend towards increasing levels of joint production can also be seen.

Six Matters To Be Addressed

To foster cooperation and develop the environmental technology supply side, six factors need to be addressed:

- Size of companies: Major companies can be encouraged to move in by favorable peripheral conditions, an expanded infrastructure, and availability of industrial sites. Financial assistance, on the other hand, should be targeted at homegrown potential in the form of small and medium-sized enterprises; the approval procedures need to be simplified as far as possible in this correction.
- Qualifications of workforce: Support for industry overwhelmingly means support for capital investment. The labor market problems arising in the new laender however require an increased investment in human resources. One possible solution would be to grant subsidies to companies that invest in workforce training in the new laender.
- Financing problems faced by eastern German environmental technology suppliers: To some extent the extraordinary depreciation allowed for environmental protection purposes overlaps with financial assistance. Claiming for extraordinary depreciation thus disqualifies the claimant from capital investment grants. As environmental investment has a dual effect, favoring both the environment and economic revival, consideration should be given to allowing extraordinary depreciation on at least the remainder of the investment (i.e., net of the grant) when investment grants are awarded.
- Organizational and financial problems facing local councils: Financial support for the appointment of administrative personnel from the western laender would be desirable. Leeway in sewage disposal, waste disposal, and street cleaning charges must be fully utilized. An alternative would be to look into whether contracting work of this type out to private companies would bring greater relief for council budgets. The limits on council overspending should be fully utilized for environmental infrastructure investment. Furthermore, the financial balance must be further weighted in favor of the new laender.
- Cooperation between experienced western German companies and local eastern German firms is essential to solve the problem of polluted sites and could be financed by setting up joint pilot and reference units, e.g., polluted site reclamation centers. If, as is to be expected, insufficient funds are available for reclamation of polluted site fund will be needed.
- Technology transfer: Setting up innovation and technology centers is not merely a matter of providing the necessary technical and intangible infrastructure. Experienced companies from the west and entrepreneurs from the east must be brought together in an aggressive strategy of creating synergies in the environmental protection sector.

Germany: Polluted Site Assessment Data Base Developed

91MI0559 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 12 Sep 91 pp 14-15

[Text] All those involved in addressing the problem of long-standing polluted sites, whether in administration, surveying, or reclamation, can now obtain data base support in their work. The TUBA (Toxicological Environment Assessment of Polluted Sites) information system has been developed for this purpose by the Health and Environment Research Company and Nowak Data Systems (both based in Frankfurt). It is of particular interest to engineering firms, civil engineering companies, and authorities or firms that have complex problems with polluted sites in their areas. TUBA is now also marketed by RauCon Bioinformatik & Consulating GmbH (Dielheim near Heidelberg).

TUBA is a multiuser system with an integrated substance data bank that combines expert knowledge on medicine, chemistry, geology, and engineering science to assess polluted sites.

It carries out an initial assessment of suspicious areas, taking account of chemical, toxicological, and also dispersion-related geological and hydrological aspects. It also offers basic information on the nature of polluted sites or dumps in a "catalogue of types of damage." The initial assessment serves to determine priorities. It uses a questionnaire-like user surface to compile data in a form that reflects the structure of the suspicious area register.

The program runs on various operating systems. It can be used in single user mode (with DOS or OS/2 on 80286 and 80386), in local markets (e.g., NOVELL or DECNET), and on multiuser computer systems (with UNIX, for example on Altos, Apple, AT&T, Bull Compaq, Data General, DEC, Hewlett-Packard, IBM, Motorola, NCR,

Nixdorf, Siemens, Sun, Unisys, and 80386- and 80486—processor PC's) without substantial differences in user surface.

Further details can be obtained from RauCon GmbH, 6912 Dielheim, Tel: 06222/73562, Fax: 74884.

Dutch Environmental Policy Plan Criticized

92AN0020 Rijswijk BIONIEUWS in Dutch 27 Sep 91 p 1

[Article by Fridus Valkema: "'Caring for the Future II' Program Alarming; Goals of National Environment Scheme Not Achieved"]

[Text] Driving a car will have to become much more expensive if we want to achieve the goals established by the National Environmental Scheme (NMP). If nothing is done, traffic will stay at its current energy consumption level for the next 20 years, whereas the NMP stipulates that it should be down by 20 percent in 2010. The CO_2 emission objective also requires additional measures, and some other NMP objectives will not be achieved, either. This was revealed by the—as yet—secret draft of the Caring for the Future II program.

Here are some excerpts:

- The construction of manure processing factories is progressing very slowly. In 1991, the capacity will probably be 3 million tonnes, while there is a need for 5.5 million tonnes. If the excess manure cannot be processed, livestock number will have to be further reduced;
- Soil contamination by nitrogen must be reduced by 85 percent, whereas only a 30 percent reduction is achieved with the present measures;
- The stock-breeding industry's energy consumption will double as a result of environmental measures such as manure processing;
- As a result of environmental measures, 30 percent of the intensive stock-breeding farms will get into trouble. In the cattle-raising industry, this percentage will range from 10 percent to 20 percent;
- The NOx emission of trucks is well above the objectives and it will have to be reduced by 70 percent. The same is true for the emission of volatile organic compounds;
- Industry will further have to reduce discharges of specific substances such as heavy metals, fine dust, and polyaromatic hydrocarbons;
- Without additional measures, industry's energy consumption will increase after 2000;
- Industry will have to do more about the cleaning up of polluted industrial sites which are in use (total cost 11 billion guilders) and against the spreading of this pollution;
- Cleaning technology and end-of-pipe solutions are insufficient. Process-integrated measures such as cleaner processes, other raw materials and additives, other products, and more internal reuse of waste products are urgently required;
- The results of a policy aimed at prevention and reuse can only be seen in the long run. For the time being, waste will therefore have to be incinerated or dumped. The total waste incineration capacity will increase from 3 to 11.5 million tonnes by 2010, including 9 million tonnes for domestic and similar waste. In order to incinerate this waste, 15 (public) incineration installations will be required with an average capacity of 600,000 tonnes;
- By 1994, most landfills will be full.

FACTORY AUTOMATION, ROBOTICS

Italy: Research Institute Establishes Robotics Laboratory

91MI0552 Turin MEDIA DUEMILA in Italian Sep 91 pp 44-45

[Text] It has been given a new name to better identify its numerous research objectives. At the Sant'Anna College in Pisa, the advanced robotics laboratory is now called Arts Lab, an acronym that stands for Advanced Robotics Technology and Systems laboratories, but that also combines the creative and intellectual capabilities of thought. A scientific and humanistic combination that strikes you immediately when visiting the ancient Benedictine convent which houses the college, its robots and computers beneath its frescoed vaults.

The Arts lab will probably become independent from the other activities of the college, which was established in 1987 following the merger of the College for University and Specialist Studies (which at one time consisted of applied science faculties not covered by the "Scuola Normale," with its renowned and glorious past) and the Conservatory of Sant'Anna. Social sciences (economics and business studies, law, political science) and experimental and applied science (agricultural studies, engineering, medicine) are the two main branches into which the College's curriculum is divided. Like the "Scuola Normale," candidates are admitted after an extremely strict selection procedure with only about 100 graduate and postgraduate students passing the entrance exam.

Now, as emphasized by Paolo Dario, assistant lecturer in biomechanics and biomachinery and guiding light of the Arts Lab, the level of expertise achieved at the advanced robotics research center is such that a real robotics laboratory has been established. That "critical mass" of human resources (two professors, four full-time university researchers, about 15 scholarship-holders, and 20 students who work at the center has been consolidated to establish an American or Japanese-style laboratory that will replace the one already in operation, which is inadequate. The Arts Lab is therefore both reference point for Italian research but also a very short-term

objective which, by the end of the year, should lead to the concrete and coordinated development of a considerable number of ambitious projects.

The robotics lab, the first center of its kind in Pisa, was developed on the basis of the experience acquired by the Enrico Piaggio center at the faculty of engineering, where an early type of artificial skin was invented. Sant'Anna optimized this new generation of tactile sensors to assemble it into a system. A robot arm whose grippers are covered entirely by a layer of artificial skin, a synthetic material with 128 "intelligent" tactile sensors is controlled by three computers, is the theorectical and practical foundation of the lab in Pisa. The robot is capable of manipulating objects and identifying their shape and solidity by means of sensorial stimuli that are transmitted by the "skin." The information acquired by the sensors is immediately sent to the control computers which process and return the data to the robot to give it an enormous degree of flexibility.

This is an example of how robots that are not necessarily programmable can be built using sensor technology, and are "intelligent" robots, with a child's level of learning or rather that of a small animal, and a good degree of autonomy compared to human operators. This trend currently dominates the robotics industry in developed countries, above all in Japan, the undisputed leader in this area.

The robot arm of the Arts Lab has given rise to other research projects such as the agricultural robot finalized project in collaboration with the University of Genoa. Projects of this type, as Paolo Dario explained, combine and exploit all the expertise required to build "intelligent" robots, and comprise technologies for the mechanical structure, sensors, electronics and computer control. Although many resources have for some time been spent on subsystems, research at the Arts Lab still hinges on the development of new motors and actuators to give the robot the techniques and flexibility which the traditional industrial robot as yet does not have.

One of Sant'Anna's best-known projects is in fact a wrist with sensors and a three-finger hand which is being developed on behalf of the Italian Space Agency (ASI). As Dario pointed out, in Pisa just like in Nagoya, leading-edge research of great interest is being carried out in this field. At present, the construction of microrobots, in line with a tendency that is gaining ground, is simple compared to the highly ambitious projects of building an anthropomorphous robot. A postgraduate research program at the Arts Lab focuses on the development of a robot measuring a few centimeters. Although not yet at the stage of Japanese cellular robots, it is comforting to know that a young graduate finally has the tools to achieve that which is commonplace in many other countries, i.e. transform his research into a prototype.

The skill of this researcher will no doubt be of use in the complex project which aims at building microrobots with personalities. Paolo Dario sees great applicational potential in this branch of research. Robots of minute dimensions which can adapt to the environment thanks to the specific sensorial capability that determines their "psychology," can be organized like a swarm of bees.

This handful of "intelligent" machines can be used for example in controlling pipes in a machine or a house, and also in principle for the human body, just like in a well-known science fiction story by Isaac Asimov. Dario, however, is more cautious and predicts a type of surgery which is minimally invasive. The "swarm" of microrobots will thus include an "explorer" robot, designed to perceive danger and possibly "sense" a gas leak. The fault can be repaired by the "sociable," robot which, using the information supplied by the "explorer," will identify the damage and remedy it. There will also be an "observer" microrobot to conduct all the operations.

What appears a highly difficult project is for Dario totally feasible by coordinating 20-30 personalities with simple processors. This is basically a distributed system whose concept and functioning is in contrast with the all-purpose robot which is virtually impossible to create with state-of-the-art technologies. That is because, as Dario added, robots with sensorial intelligence, such as those under research at the Arts Lab, only simulate the structure of animal (and human) behavior, whereas intelligent computers, and therefore android robots, actually simulate intelligence, that is, a system of mechanisms which are for the most part still unknown.

The success of these "group" microrobots should not be taken for granted as demonstrated by the interest of many Japanese scientists in the research performed at the Pisa robotics laboratory. The intuitions of Dario and his coworkers are particularly attractive for those who, in the Land of the Rising Sun, are investing billions of yen in micromachines. According to Dario, the reason goes beyond applications which are of undoubted importance, such as control of machinery etc. The Japanese are in fact realizing that it is no longer sufficient to invent microchips, the important thing now is to be able to assemble them. This therefore requires micromachines to build a mini-automation system that will soon create the "automatic micro-factory."

The Arts Lab is also working with the University of Genoa on an international program for the development of a small robot head with mobile eyes. The invention of a retina system with these dimensions is the task of the laboratory in Pisa. Dario is very keen on reiterating that every area of research in Pisa is always backed up by actual constructions, to constantly assess the future potential and possibilities of research itself. This opinion Dario claims, is not shared by many who consider that it means dirtying one's hands with technology rather than concentrating on theories. At Sant'Anna the role of engineering is upheld without half measures as is the design and construction of all types of systems starting from the lowest level.

Dario has also proposed setting up Italy's first course on mechatronics. At the end of the first year, all the students

on this course will have to build a robot prototype, just like students in the United States, Japan, and other European countries. The custom of "getting their hands dirty" in this way means seeing theories transformed into an object which moves and does things. This is most likely the secret behind Paolo Dario's enthusiasm, which is uncommon in the Italian academic world. An enthusiasm which could infect the many students who cannot see the immediate results of their efforts and the true meaning of their studies. They may discover that designing and building a robot is a wonderful experience.

UK Machine Tool Industry Increases Use of CIM

92WS0066C Duesseldorf VDI NACHRICHTEN in German 13 Sep 91 p 34

[Article by Arthur Fryatt: "Machine Construction Must Pay its Own Way: CIM Grows With the Needs; Computer-Integrated Manufacturing [CIM] Improves the Market Chances of British Companies"]

[Text] British companies have made a lot of progress in converting the idea of computer-integrated manufacturing into practice. One prerequisite for this was an advanced domestic technology. However, it also received several stimuli from foreign countries because many consider the British isles a "technological aircraft carrier" off the coast of Europe.

The central focus of every CIM system is not the "I" representing the integration aspect. It is still the hardware, the computer control system, that holds the entire system together. Therefore, a machine-tool manufacturer such as Giddings & Lewis in Angus, Scotland, and the British subsidiary of an American group of companies, developed its own manufacturing cell control system, the CM9000.

A manufacturing cell integrates numerically controlled machine tools, an automatic material handling system and a cell control system. The control system is responsible for the material handling system and processing the workpieces. In combination with the assessment of a machine operator, this represents an optimal use of the equipment.

The CM9000 Cell Control System consists of two parts. One part is the "Cell Manager" equipped with the required logic. This manager specifies the processing steps for each workpiece in the cell. The other part is the "Material Handling System" that controls the transport equipment for palettes and workpieces around the cell. Examples of material handling systems are carousel workpiece changers, rail-bound transport carts, automatically controlled vehicles and robots.

Computer simulation does not just play a part in the development of CIM systems by machine tool manufacturers. They use from the first analysis up to the design, from planning the transfer equipment, delivery and installation of the machine tools, start-up and maintenance in a production environment. Computer simulation also may be useful for sales and service companies for increasing productivity. Siman/Cinema from Hawker Siddeley, for example, is one such simulation program.

Using this program, a computer model for a production or process plan can be run for a simulated period. In this way, management, engineers and machine operators can see in minutes of computer time just how the production systems will function for weeks and months in real time.

After creating such a background, the positions of workstations, queues, operator paths, forklifts and the like can be added. Variables such as real time, the degree of machine use, and container quantities may be displayed either as numbers or as dynamic levels on the screen.

Together with the software, system and consulting firm Logica, Hawker Siddeley has founded a joint venture named Cimulation Centre. This venture makes its headquarters in the business offices of Hawker Siddeley in Chippenham. One of its services is practical CIM consultation using Siman/Cinema. They provide detailed assessments before the customer makes an investment and they check new ideas for manufacturing and sales companies.

Desoutter Ltd., a screw-cutting tool manufacturer in London, has implemented CIM. The plant manufactures more than 1000 different tool types. The manufacturing program HMS from Bull, the British subsidiary of the French conglomerate, runs on the computer at Desoutter.

Before, the sales and manufacturing systems transferred information in batches. The computer running the HMS software integrates the sales system with the constantly updated manufacturing system. HMS allows just-in-time production reducing warehouse inventory and shortening the time between receipt of customer orders and delivery of the product.

The diesel engine builder Cummins Engines uses hardware and software from Bull as an advanced computer controlled data processing system. This system controls various shop machines and follows the individual manufacturing steps. A suite of programs, the Assembly Information Management System (AIMS) forms the nucleus. AIMS controls the entire engine assembly process. The system monitors and controls the manufacturing steps of each engine on the assembly line. It electronically distributes the identification characteristics of each engine to the various assembly units within the factory. By using AIMS, neither information nor semi-finished engines become lost when these engines leave the production line for inspection purposes. The current production plan is for 40,000 engines annually although the CIM system, and even AIMS, can handle 70,000 annually.

LASERS, SENSORS, OPTICS

Germany: Trends in Laser Research, Subsidies

92P60014A Duesseldorf VDI-Z in German Sep 91 p 48

[Text] With a share of about 27 percent of the world market, the FRG has a leading role among the suppliers

of lasers and laser systems on the international market. A considerable contribution to this was made by the BMFT (Federal Ministry of Research and Technology) in recent years. From 1987 to 1990, this ministry gave subsidies amounting to 125 million German marks [DM] for the development of high performance lasers and their application in material processing. The results of these projects were quickly converted into industrial application in the framework of transfer measures, such as the mobile laser processing center.

According to a study by the IFO Institute in Munich, only about 20 percent of the potential applications of high-performance lasers have been exploited in material processing for cutting, welding, and surface working. Particularly the use of lasers in small and medium enterprises has been characterized by numerous initial obstacles. What is particularly lacking is basic information on the applications of lasers.

Other application-oriented basic research is also necessary, for example in the broad field of precision machining with high-power lasers. This includes such topics as abrasion with CO_2 lasers, micromachining with solid state lasers or new depositing processes with the excimer laser. For that reason, one is planning to continue for another period the subsidy focal point "Laser Research and Laser Technology" in which the bases for new laser applications are to receive significant emphasis. The following aims can already be seen:

— To use basic projects to lay the foundation for the laser technology of the future.

— To use application-oriented measures to ensure a further spread of laser technology, particularly in the case of small and medium enterprises.

The continuation of the promotion of lasers is particularly important for the new federal laender, which in the next few years will catch up with western developments, especially in the applications industry. Support by the Federal Ministry of Research will also be essential for the laser research which is just beginning there in the universities and the two planned extrauniversity institutes in Dresden and (East) Berlin. Total financing in the amount of DM60 million annually is foreseen, starting in 1992, for laser research and laser technology.

German Research Ministry Announces Photonics Program

91MI0558 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 12 Sep 91 pp 12-13

[Text] Computers with the speed of light, optical data processing and storage with light, in other words the optical computer, are visions of the future founded on photonics, a new basis for information technology. Substantially more information can be transferred using light beams than with electronic signals, as photons disperse at extremely high speeds (300,000 km/s). In the future, photonics will therefore take on a significance for information technology similar to that of microelectronics today.

The approach taken by the new Federal Ministry of Research and Technology [BMFT] "Photonics" funding program is therefore to use photons instead of electrons, i.e., to use light as an information carrier. Scientists from industry, research institutes, and universities are working closely together on two comprehensive joint projects, one on Optical Link Technology and the other on Optical Signal Processing.

The purpose of the research and development work is to explore the new opportunities offered by photonics and to demonstrate them in actual systems.

Thirty projects have recently been approved under these two overall joint projects for a total cost of 140 million German marks [DM], of which approximately DM90 million will be paid in BMFT grants. The projects will last four years. A total of 15 scientific teams from university institutes, the Fraunhofer Institute of Applied Solid-State Physics, the Heinrich Hertz Institute, and the companies ANT, Daimler-Benz, SEL [Standard Elektrik Lorenz], and Siemens are working closely together on these two joint projects. Investment by industry is subsidized by up to 50 percent; the BMFT is contributing 75 percent to university and research institute expenditure, and 25 percent will be paid by industry.

In view of the significance of optoelectronics/photonics, this funding program was also coordinated with other organizations such as the Volkswagen Foundation, the German Research Association (DFG), and the land of Baden-Wuerttemberg, all of which had initiated similar programs, thus guaranteeing that they will all be closely linked. Joint seminars will be arranged to ensure that information is exchanged among the individual research teams.

Although the budget is tight, the first phase of this research program is thus gathering the necessary momentum, and a strategic emphasis is being set for research policy. It has been possible to include every major research partner in the project and to define a concerted joint program. Over the period 1990-1993, about DM180 million are being made available for photonics R&D funding in industry and science. This amount includes about DM10 million per year agreed on with the BMFT in DFG, Volkwagen Institute, and Land of Baden Wuerttemberg for basic-research oriented work at universities and scientific facilities. It is further planned to include the research potential in the new federal laender in this program with funds amounting to approximately DM5 million per year.

The trend away from electronics towards photonics is based on progress in III-V compound semiconductors such as gallium arsenide (GaAs) and indium phosphide (InP). These material systems make it possible to produce optoelectronic components (semiconductor laser

diodes integrated with electronic circuits) in which, alongside the electrons, photons are used as the major information carriers.

The advantages of photonics come into play primarily in optical link technology, since great problems have already been experienced in electronic links at data rates above 140 MHZ. For example, disturbance such as crosstalk and reflection occurs at these high frequencies during the transfer of large quantities of data in electrical trunk lines. This limits the development of extremely fast information technology systems, since data transfer is largely impossible at even higher frequencies. Photons, as opposed to electrons, do not interact with each other, so converting electrical signals into light signals and transmitting them via glass fiber will bring the decisive breakthrough.

Data transfer with photons is already established practice in fiber optics and has proved economic to use, particularly in telecommunications. Moreover, optical signals do not necessarily have to be carried along glass fibers. Photons, i.e., light signals can also be transmitted through free space or from one to several other points at the same time via projection lenses. The current, highly sophisticated wiring and bonding work involved in highly complex systems may thus be avoided.

Optical link technology thus makes for a new degree of freedom in electronic systems. For example, many optical processors can communicate with each other simultaneously via a light beam.

An optical computer is conceivable as the ultimate objective; it would be very much faster at the highest level of parallelism than the current electronic super computer.

The optical light signals, which provide the link between the optical processors or the individual assemblies in highly complex systems, must first be converted into electrical signals for each switching process. These electrical signals are subsequently converted back into optical signals for relaying along the line. Each item of information must therefore pass through the bottle neck of optoelectronic conversion, which considerably limits data flow. The objective is therefore to develop components capable of performing these switching processes optically as well, thus achieving entirely optical signal processing.

Italian Consortium To Build ESO Telescope Instruments

92P60058B Duesseldorf VDI NACHRICHTEN in German 1 Nov 91 p 22

[Article: "Italian Contract"]

[Text] The four individual instruments for the 16-meter telescope system of the European Southern Observatory (ESO) will be built by a consortium of three Italian firms. This was announced by the central office of the observatory in Garching near Munich. The contract included the building of all steel constructions, the hydrostatic bearings, and the motors to drive the four instruments, each of which weighs approximately 44 tonnes. The instruments' ceramic glass mirror mounts will be manufactured by the Schott glass factory in Mainz and will be optically final-ground by a French company. Components of the first telescope are to be erected by as early as the end of 1994 on the 2640-meter-high Cerro Paranal in the Chilean Andes, about 130 kilometers south of the port city of Antofagasta.

MICROELECTRONICS

First Phase of Eurochip ESPRIT Program Called Successful

92AN0022 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 10 Oct 91 p 6

[Article by Raphael Font: "Training: Increased Effort for Circuit Designers"]

[Text] The European Eurochip program is entering its second phase—the number of affiliated organizations will increase, more services will be offered, and closer relations will be sought with industry.

Two years after its inauguration, the very-large-scale iogether some 300 delegates from the 200 institutions of higher learning or research participating in the program, the goal was set to attract another 100 new participants to the program during the next three years. The intention to expand the services offerentegration (VLSI) "Eurochip" project, which is a European program to promote the training of integrated circuit designers, has recently entered its second phase. During a workshop held in Grenoble from 30 September through 2 October 1991, which brought td and to get closer to industry was also noted. The annual budget which the EC will allocate from 1991 until 1994 for the VLSI project—a subproject of the European Strategic Program for Research and Development in Information Technologies (ESPRIT)—should remain stable compared to the first phase, i.e., close to 14 million European currency units (100 million French francs).

The initial phase of the VLSI project has been a success, project officials pointed out. Here are some figures: 1,500 computer-aided design (CAD) software licenses ordered by participating organizations; 500 workstations installed; 50 testers; 1,000 circuits designed, and 500 produced.

Unhoped For Results

One of the major goals of the program was to double the annual European production of integrated circuit designers. "The goal has been achieved. We went from 3,000 designers per year in 1989 to 6,000 this year," said Bernard Courtois, one of the French project managers. "The results achieved are beyond what we had hoped for. The program is today unequaled in the world."

For the program's second phase, it is planned to expand the supply of software offered to member organizations—especially systems design tools and mixed analog-digital design tools.

Another development to emerge from phase 1 should be greater cooperation among organizations. These today have often become used to the practice of working together on European R&D projects. This cooperation remains limited, however, in the field of teaching. In particular, phase 2 of the VLSI project should promote exchanges of CAD software developed in-house by member organizations.

Another trend promoted by the second phase will be a greater opening to industry. It is recognized that the program has until now remained somewhat restricted to the world of academia. The program managers have confirmed their intention to be more attentive to the needs of industry. It is planned that courses be given by engineers. An opening to the countries of Eastern Europe is also planned.

JESSI, Sematech To Cooperate in Semiconductor Research

92AN0006 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 26 Sep 91 pp 1, 9

[Article by Frederic Fassot: "A Holy Alliance in Equipment"]

[Text] Americans and Europeans will carry out joint research for the development of semiconductor equipment.

The participants in the Joint European Submicron Silicon Initiative (JESSI) and the American Sematech consortium are going to cooperate in the area of equipment and materials for the production of semiconductors. It is all settled. By announcing, last Friday, the scope of their future collaboration, the representatives of JESSI and Sematech disclosed the discussions initiated two years ago. "From the very outset, we attempted to cooperate with Sematech on semiconductor technologies, but the door has remained firmly shut. Defining common standards met with more success, while in the field of equipment development, the interests of the two parties converged," confided a spokesman for JESSI.

The arrangement is still very vague. It covers two essential themes: The two organizations are going to be able to collaborate, on the one hand, in projects on standards definition and equipment analysis and certification and, on the other hand, in complementary projects requiring expertise of one organization, which the other does not have.

Officially, no specific collaboration project has been defined to date and all future cooperative research will have to receive prior approval.

The goal of the agreement is to strengthen the competitiveness of the members of the two organizations, to avoid duplication of research and of available resources in order to allow economies of scale, and to speed up development of new manufacturing processes, equipment, and materials for semiconductor production. According to Sematech, this agreement will allow the American consortium to include a larger number of technologies than it would have been able to relying only on its own resources. In addition, it will give its members a better understanding with respect to their European suppliers. The subject matter for collaboration is still under discussion, but Sematech feels that research in modeling, packaging, and materials could offer its members an immediate, tangible benefit. Despite all that, the European companies will not be allowed to aspire to becoming members of Sematech, which will remain exclusively American.

Carrying Out a Sound Project Vis-a-Vis the Japanese

By and large, this undertaking is being positively accepted within the industry, which prefers nonetheless to have more details prior to making any official comments. However, do Europe and the United States have any other choice than sharing their research programs? Because, for everyone, the common enemy is Japan. The Japanese hold almost 50 percent of the market for manufacturing equipment, compared to 30 percent for the Americans and 15 percent for the Europeans. Thus, it is imperative to move quickly (it has already taken two years, a period of time which some attribute to procrastination by Philips and Siemens) in order to incorporate all the fields of research on projected manufacturing equipment. "In Europe, there exists no project dealing with ion implantation, and no short-term project on X-ray lithography," comments one observer. "Moreover, there is a lack of sufficiently reliable European manufacturers to deal with all aspects of multiprocessing machines (the famous Clustertools). For its part, Sematech is a little weak in optical lithography despite the presence on American soil of SVG Lithography (formerly Perkin-Elmer)." Thus, a research partnership involving SVG Lithography and ASM Lithography would certainly be welcomed and would receive the blessing of IBM, which owns shares in the former and is associated with the latter in a JESSI project.

Above all, this cooperation is deemed advantageous for some internationally operating European equipment and materials manufacturers, which will be able to gain access to American research and markets: ASM International, ASM Lithography, and Electrotech for machinery; and Wacker, MEMC, and Air Liquide for materials are the companies most often cited.

However, some people are playing down the impact of the agreement; European semiconductor manufacturers continue, as in the past, to purchase equipment from the large American equipment manufacturers (Applied Materials, Varian, or Eaton) or from the Japanese. Regardless of the programs, equipment suppliers have been collaborating with semiconductor manufacturers for ages, without regard to nationality. Still, there remains an incentive not to be disregarded, i.e., the money to be allocated to the programs: 15 percent of the 20 billion French francs [Fr] over eight years for the

JESSI subprogram "Equipment and Machinery," and Fr1.2 billion per year for 10 years for Sematech.

In the end, the big winner under this agreement is IBM, which will cash in on a certain access to American technology against acknowledgment of its European identity. Big Blue is said to have submitted research projects to JESSI with regard to mask manufacturing, deep-ultraviolet lithography (together with ASM Lithography), and automation. The lithography project, especially, has already received the JESSI label. Its financing has to be approved by the various governments involved in 1992. If it is accepted, IBM will have its European passport.

European Semiconductor Developments Analyzed

91AN0562 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 19 Sep 91 pp 1, 20

[Article by Francoise Grosvalet: "ESSCIRC '91: European Semiconductor Research Running out of Steam"]

[Text] The telecommunications, consumer electronics, and automotive sectors remain—with the support of analog and mixed hybrid technologies—the focal applications for the European semiconductor industry. They continue to be the major force behind a research effort that seems to be running out of steam.

Attention should be drawn, however, to a new trend toward system integration that could prove an additional force for the Europeans against their Japanese and U.S. competitors.

In this regard, the 17th edition of ESSCIRC, the European Conference on Solid State Circuits held in Milan last week, was true to the tradition. It featured presentations in these areas, even if this year, according to certain reports, the talks were not at the level they might have been.

The wave of European conferences on application-specific circuits or computer-aided design (CAD) probably explains in some measure the drop in quality experienced.

ESSCIRC '91 still managed to present a number of original high-definition television (HDTV) developments, with, in particular, a circuit for HDTV developed by the French Joint Center for Television and Telecommunications Studies (CCETT) to be used in the Thomson cameras during the filming of the 1992 Olympic Games; there were also interesting developments in telecommunications, especially for the Special Mobile Group (GSM) standard and broadband integrated services digital networks (ISDN), as well as in the automotive field.

In addition, advances were also made in following areas: the area of purely analog technology (especially a range of amplifiers in complementary metal-oxide semiconductor (CMOS) technology operating in the Gigahertz band (University of Dortmund), a gallium arsenide high-electron-mobility transistor (HEMT) comparator operating at 4 Gech/s (Fraunhofer Institute, Erlangen), and a 10-bit bipolar technology sampler-blocker circuit operating at 120 MHz (Philips)); in the area of vision systems (with an analog memory developed by the University of Bologna and a systolic processor that estimates movement developed by the Catholic University of Louvain); and in the area of integrated testing.

Fuzzy Logic and Neural Networks in Automotive Applications

For the first time this year—but it could become a habit—ESSCIRC also gave the floor to user-supplier teams on specific subjects, such as automotive technology, HDTV, and telecommunications. It is a way of showing that there is a convergence of interests among various groups and that all the European actors must band together if they want to resist the pressure of their competitors. Thus, in the automotive field, Professor Panizza of FIAT and Doctor Melbert of Siemens share the view that fuzzy logic and neural networks should soon make their entry in the automotive field alongside more conventional circuits such as sensors, microcontrollers, and other flash memories. These new technologies are expected to be used first in collision-avoidance driving-management assistance systems.

In the HDTV field, the CCETT has developed—in collaboration with the Grenoble-based National Center for Telecommunications Studies (CNET) and Thomson LRE in Rennes—an HD-MAC- [High-Definition Multiplexed Analog Component] band reduction encoder circuit developed under the EUREKA HDTV program. The encoder allows the HDTV signal passband to be compressed by a factor of four, thereby making it compatible with a MAC packet transmission. The CCETT circuit, dubbed "CEB" for "calcul d'erreur par bloc" (error computation by block), performs error computation functions (also called cost function) between two digital video images. It calculates the differences between two blocks of rectangular pixels of two HDTV frames, the original frame and the restituted frame, to permit an "a posteriori" decision on three types of image-block-encoding algorithms. It operates at 54 MHz. The CEB is expected to be used in a HDTV encoder developed by Thomson to supply MAC-compatible HDTV signals for the 1992 Olympic Games. It is programmable to be able to adapt to various encoder functions and can also support a large number of block sizes and a variety of error computation functions.

Error computations based on block structures, such as those generated by the CEB, are current operations in image coding. These operations are primarily located in the encoding equipment—for example, in the movement estimators—as well as in the decision and selection functions following processing. Thus, the CEB can be used not only in quadratic error computation that serves to support the HD-MAC band reduction-encoder decisional function, but also each time that an accumulation operation is sought on the pixel blocks of two images

scanned in the normal way. The HD-MAC band reduction encoder also contains up to 80 CEB movement estimation circuits and three postfiltering decisional circuits.

The CEB is composed of a computation stage at pixel level followed by an accumulation stage at block level. The memorization stage is a 432 x 32 bit programmable delay circuit based on a 6.75-mm^2 silicon surface in 1-micron CMOS technology. This delay circuit, an improved version of the circuit developed by CNET-Grenoble, stores the intermediate computations of each block constituting an image line. A sequencer manages all the accumulation and storage computation units. Maximum processing speed is 54 megapixels/s. The input and output data are coded in two's complement on 9 and 32 bits, respectively. The total circuit measures 38 mm^2 and integrates 80,000 transistors. It consumes 400 mW at 27 MHz and 5V. Initial prototypes have been produced by European Silicon Structures (ES2).

In the area of circuits for telecommunications purposes, the two main subjects of current concern on the part of the Europeans are: the GSM (the pan-European digital mobile telephone) and the asynchronous transfer mode (ATM) circuit for wideband ISDN. With regard to GSM, Alcatel has developed a codec that integrates, on a single chip, a digital signal processor (DSP) and the analog stages which permit development of a portable terminal. This circuit comprises a DSP, an analog-to-digital convertor (ADC), a digital-to-analog convertor (DAC), and a micro and loudspeaker interface—all on a 14-mm^2 chip in 1.2-micron CMOS technology. The analog portion constitutes 50 percent of the chip's surface. Consumption is 25 mW at 5V (100 microwatt at rest). The codec has a dynamic range of 13 bits, with a linearity of 10 bits. For its part, Philips has developed a 16-bit digital signal processor that integrates all the GSM station baseband processing functions. This 1-cm^2 circuit is not suitable for portable terminals. The Philips DSP conforms to GSM as regards memory size (2K x 16 bits of random-access memory (RAM) and 4K x 16 bits of read-only memory (ROM)) and power consumption.

For ATM, Siemens developed a circuit with approximately the same functions as the CNET circuit already described in an earlier issue of ELECTRONIQUE INTERNATIONAL HEBDO and which was also presented in Milan. With a 216-mm^2-size chip, however, the industrial future of the Siemens circuit seems dubious.

In the automotive field, SGS-Thomson has developed, in collaboration with Marelli Autronica, a multifunction voltage regulator specifically for automotive applications. In bipolar hybrid and CMOS technology, this circuit integrates four 5V low-voltage-drop regulators. Among the other innovative ESSCIRC '91 presentations, we noted a 135-MHz color image controller that makes it possible to replace six circuits in a graphic system. This circuit, developed by Inmos, integrates all display and control functions, including a cursor. In 1.1-micron CMOS technology, it is directly compatible with a 64-bit host processor. For its part, Siemens has developed an interface circuit that allows data transmission and feed without contact between a fixed terminal and a mobile carrier such as a smart card or any other identification system. This circuit, which is placed on the mobile carrier, uses an inductive transmission technology. It allows direct voltage to be generated from an RF signal (induced by a pair of transformers included in the mobile carrier) and supplies bidirectional data transmission between the terminal and the nonvolatile memory integrated on the card (in the case of a smart-card-type mobile carrier). We would also point out a specific circuit for static random-access memory (SRAM) network testing in printed circuits. This SRAM tester, developed by SGS-Thomson, is JTAG-compatible and incorporates a self-testing capability.

ESPRIT III Euromicroprocessor Program Goals Outlined

91AN0552 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 5 Sep 91 p 7

[Article signed M.H.: "ESPRIT III: Call for Proposals for Euromicroprocessor"]

[Text] The EC's European Strategic Program for Research and Development in Information Technologies (ESPRIT) is to commit 1.6 billion French francs [Fr] to microelectronics over four years. Most of this will go to the Open Microsystems Initiative (OMI).

In the area of new-generation microprocessors, Europe is trying to move ahead with one of its ambitions: to make the European components industry competitive in relation to world giants in the sector by the end of the decade. Unveiled at the beginning of the summer, the OMI program has recently been the object of a specific call for proposals. The closing date for applications is 14 October. This program falls within the framework of the EC's ESPRIT III research program covering the 1991-1995 period. With a total budget of 1,350 million European currrency units [ECU] (about Fr9.25 billion), this initial call for proposals is addressed to five major sectors in information technology: information processing systems and software; advanced office automation and integrated home systems; computer integrated manufacturing; engineering; and microelectronics. The latter, which includes the OMI program, has been granted a global package of ECU235 million (about Fr1.6 million).

Promoting a New Reduced Instruction Set Computer (RISC) Generation

The main objective of OMI is to supply around 1995 a set of development and applications systems and software which will also be compatible with existing standards. OMI aims to provide the necessary infrastructure for the support and development of a new family of microsystems based on a 64-bit processor integrating nearly 100 million transistors in 0.3-micron technology.

The project provides especially for the definition of circuits and macrocells that are fully compatible with existing ones. It also seeks to produce demonstration

systems of development tools and applied systems software. Another OMI objective is the development of the post-RISC generation, which will allow a transition phase for users of current technologies such as MIPS [microprocessor without interlocked pipeline stages] and SPARC [scalable processor architecture].

Other than the OMI initiative, additional R&D activities will be developed during this new phase of the ESPRIT program in the microelectronics sector with one objective: to strengthen the overall capacity of European industry in the design and development of a new generation of integrated circuits and application-specific integrated circuits (ASIC's) through maximum coordination with the JESSI program. ESPRIT III will, during the next five years, focus on semiconductor technologies, the development of the complementary metal-oxide semiconductor (CMOS) processes for logical circuits, optoelectronics, and sensors.

SGS-Thomson, Plessey To Set European ASIC Standard

91AN0553 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 5 Sep 91 p 9

[Article by Franoise Grosvalet: "SGS-Thomson and GEC Plessey Join Forces for a European ASIC Standard"]

[Text] By jointly developing a family of standard cell circuits, SGS-Thomson and GEC Plessey Semiconductors hope to become the European reference in this area.

SGS-Thomson and GEC Plessey Semiconductors (GPS), both ranking among the European market leaders in application-specific integrated circuits (ASIC's), have decided to share the development costs of a family of standard cell circuits in 0.7-micron complementary metal-oxide semiconductor (CMOS) technology to better meet the onslaught of Japanese (and American) manufacturers and to establish a European reference in the field. Neither company intends limiting its offensive to the European market. This agreement will also affect users because it means that from the beginning of next year two fully compatible supply sources will exist in Europe. Products developed by the two companies will be directly interchangeable at the level of masks. To achieve this, GPS will adopt SGS-Thomson's 0.7-micron geometry (a technology in production in Agrate and Dallas) to ensure electrical compatibility.

Future Cooperation in Gate Arrays and FPGA's [Field-Programmable Gate Arrays]

The agreement does not provide for any exchange of technology because each company is relying on its own developments in this field. The cell libraries developed by SGS-Thomson and GPS will be usable on most workstations currently available on the market. Both parties have also decided to pool their resources to reinforce their computer-aided design (CAD) tools and to develop new cells. Eventually, by the end of next year, CAD systems installed in design centers in both companies should be identical.

Both partners also anticipate that future cooperation could be extended to include field-programmable gate arrays, a sector in which GPS is already present. Furthermore, they will examine the possibility of jointly developing "sea-of-gates" circuits in 0.5-micron technology.

Development tasks were shared out on the basis of the capacity of each company. For instance, the dual-port random-access memory (RAM) cells will be developed by SGS-Thomson while everything concerning the core of the digital signal processor goes to GPS. This corresponds to eight man-years each for the library development part alone.

Other than the obvious impact on users, the agreement will enable GPS and SGS-Thomson to improve supply by reducing the development time by a factor of two. The agreement initially covers digital circuits only, but is not limited to this aspect alone and the development of analog and mixed cells could follow in 1992 and 1993. Together, both companies today hold about 5 to 6 percent of the world market in application-specific circuits. Number seven in the world league tables in gate arrays, according to Dataquest, GEC Plessey Semiconductors' annual sales figures amount to $400 million, 70 percent of which from integrated circuits. The company realizes 32 percent of its sales in the United States, 25 percent in the United Kingdom, 25 percent in Europe, and 18 percent in Asia. With a turnover of $1.5 billion in 1990, SGS-Thomson controls 3 percent of the world market in ASIC's. The French-Italian firm clears 40 percent of its sales in application-specific and dedicated circuits. Europe accounts for 62 percent of its turnover, the United States for 21 percent, Asia for 21 percent, and Japan for 3 percent.

Belgiium's MIETEC To Double Submicron Production Capacity

92AN0002 Kalmthout INDUSTRIE in Dutch Oct 91 p 9

[Article signed W.H.: "MIETEC Builds Submicron Factory"]

[Text] In July the chip manufacturer MIETEC began to build a new producion facility. This will place MIETEC in the position of being able to produce application-specific integrated circuits (ASIC's) with submicron geometry and to double its present capacity.

At the moment MIETEC is a part of the French Alcatel group. The present factory in Oudenaarde dates from the end of 1985 and has reached its maximum capacity; 160,000 wafers with a 100-mm diameter, annually. Moreover, the present machine park is equipped to deal with linewidths of 3 to 1.2 microns.

Technically this is no longer sufficient. MIETEC will therefore be investing 3.5 billion Belgian francs by 1996 both to increase capacity and to improve technology.

The new factory will have a class-1 clean-room facility of some 3,000 square meters for dust particles of 0.1 micron in size. The equipment and processes will allow

the production of ASIC's of 0.8 to 0.5 microns and smaller, for which MIETEC has obtained a licence from the French company SGS Thomson. Walter Matheus, director of operations: "We will gradually extend capacity. The factory will be operational by the middle of 1993 and will then be able to produce 15,000 wafers with a diameter of 150 mm. By 1996, the end of the first phase, we will be making 60,000 wafers annually. In a second phase we will extend the capacity of the factory still further to 150,000 wafers per year."

He would not confirm anything about the amount of investment for phase 2. He estimated this to be two to three times as much as the present investment. The extension of phase 1 means jobs for 100 more people. MIETEC now has some 400 employees in Oudenaarde. A further 65 people work in the headquarters in Brussels and in sales offices in Munich, Paris, London, and Turin.

At the moment the foundations are ready, but MIETEC still has not found a contractor for the construction. The building has to be ready by the end of the first quarter of 1992. A start must be made during the second quarter with the installation of the production machinery, while the production processes and qualification tests will follow in the fourth quarter.

MIETEC specializes in complementary metal-oxide semiconductors (CMOS) and BiCMOS (Bipolar CMOS) mixed analog and digital technologies. Some 70 percent of the present production goes to the mother company, Alcatel. The remaining 30 percent goes to other telecommunications manufacturers or finds its way into the automobile sector and the electronics industry. MIETEC's most important competitors are VLSI Technology, LSI Logic, SGS Thomson, and Austria Microsystems.

France: CNET Improves Fabrication of Optoelectronic Components

92AN0011 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 26 Sep 91 p 24

[Article signed F.L. and P.A.: "CNET Engages in Multiquantum-Well Technologies"]

[Text] Homogeneity and reproducibility, those are two criteria mastered by the National Center for Telecommunications Studies (CNET) for multiquantum-well (MQW) optoelectronic components.

Within two years, MQW structures have revolutionized InGaAsP-based optoelectronic components. However, reproducible development of this type of structure and obtaining uniform characteristics on large substrates remain the order of the day. The main problem consists in the thickness of the superposed layers, which must be in the order of 10 to 30 interatomic distances. CNET took up the challenge with an optoelectronic components fabrication process based on metal-organic vapor-phase epitaxy (MOVPE). The Bagneux researchers emphasize the homogeneous thickness and composition achieved with deposits made—a detail of importance—under atmospheric pressure. This means that, eventually, production of such components will no longer require the costly operation of individual testing and sorting before installation.

The design of the reactor—called "T-shaped reactor," the 1991 CNET Award—combines the advantages of vertical tubes and horizontal reactors. Gases move parallel to the substrate in the horizontal section of the system. This makes it possible to produce clearcut transitions between the layers with different compositions. At the same time, substrates rest on a rotary support—as in a vertical reactor—which results in an improved lateral uniformity of layers.

Improving the Process of Epitaxy

Alongside these studies, CNET at Bagneux is also striving to improve, in the short or medium term, the reproducibility of the epitaxy process. This is done by controlling growth temperature—an extremely critical parameter in the case of InGaAsP alloys with 1.3-micron layers—and by maintaining uniformity on the entire substrate surface within a one-degree margin. The CNET reactor allows loading and unloading of substrates without the enclosure having to be opened to air; the substrates are moved via clean zones. Several growth processes are thus made possible every day.

The laboratory has also begun working on an accurate dosing system (to 1/1,000th) for feeding metal-organic components into the reactor. "Existing commercial sources offer a bad dosing accuracy and reproducibility, especially for trimethylindium. The porous barrier diffusion sources developed and patented by CNET solves that problem," explains Andrei Mircea, chief of the optoelectronic and semiconductor materials group at CNET Bagneux.

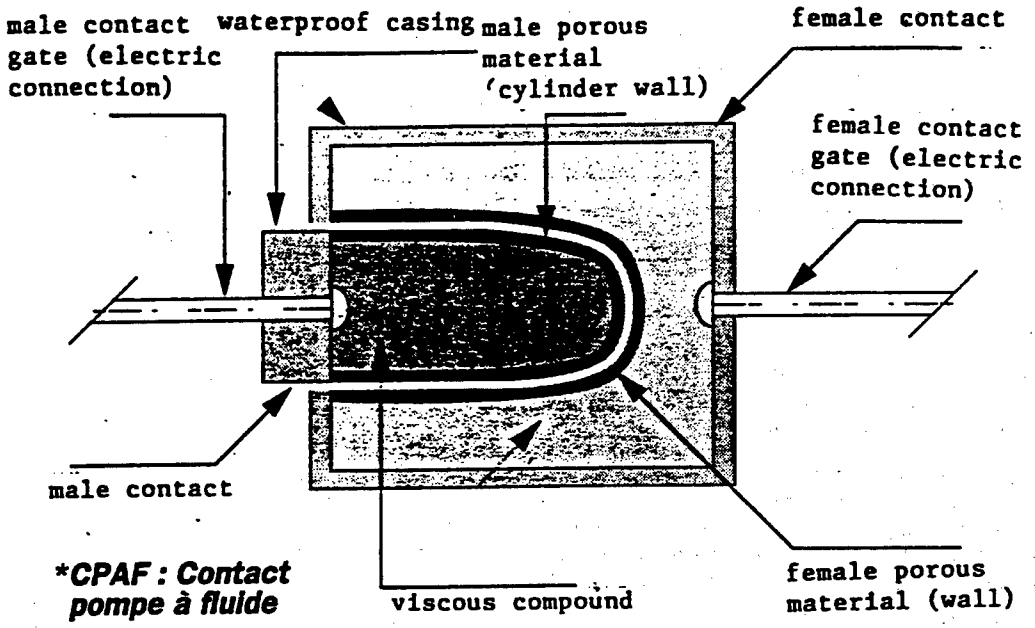
As far as finished components are concerned, the combination of all these technologies has led to enviable results, such as the lowest threshold current reported in Europe for an InGaAsP laser (1.7 mA). At the present time, CNET is extending the process in order to scale up production (75-mm substrates and simultaneous growth on three substrates are at the prototype stage). Industry has already shown interest, and the know-how—protected by four patents—was transferred under a nonexclusive contract to Alcatel-CSO. CNET also hopes to find foreign outlets.

[Box]

Imminent Phosphine Substitute?

A program for the implementation of new metal-organic compounds as precursors in epitaxial processes is supported by the EC within the framework of the European Strategic Program for Research and Development in Information Technologies (ESPRIT). The project, called Metal-Organic Research for Semiconductor Epitaxy (MORSE), was launched in January 1990 for a three-year period. It is led by Thomson-CSF and brings together several European laboratories, including CNET

Layout of the CPAF Fluid Contact



The metallic particles of the viscous compounds form a film on the external faces of the two elements. The contact is then produced as a result of a tunneling- and/or semiconductor effect.

and the UK Royal Signals and Radar Establishment. One of its goals is to develop substitutes for highly toxic phosphine which could produce equal performances in optoelectronic components. This goal has been achieved by CNET in Bagneux with the development of a TBP (tertiary butylphosphine)-based 1.3 micron laser with MOVPE-embedded heterostructures. However more expensive, TBP is liquid at ambient pressure and temperature and 100 times less toxic than Phosphine.

French Company Develops Electrical Fluid Contact

92AN0010 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 26 Sep 91 p 27

[Article signed F.L.: "A Fluid Contact Comes Under Study"]

[Text] The French small- to medium-sized enterprise (SME) Cetra is developing a nonmetal-to-metal electrical contact.

For several years, the idea of a contact which did not rely on the typical metal-to-metal technology has been running through the head of Jean-Claude Moisand, one of the three founders of Cetra, a French research SME located in the Paris area. His dream has come true. Such a fluid contact was the subject of a preparatory study terminated last September, which was funded by a BRITE/EURAM [EC program for innovative industrial technologies and advanced materials] contract. In addition to Cetra, various universities took part—those of Strasbourg, Limoges, Le Mans in France, and that of Limbourg in Belgium—as well as the European School of Chemistry at Strasbourg. Now, Cetra is continuing to research on its own, but is waiting for a research contract from the National Center for Telecommunications Studies (CNET) this very month.

The objective is to produce an electrical contact utilizing new materials (porous materials, polymers, submicron metallic particles). As for the operating principle, the image of a wet sponge can facilitate understanding; when a sponge full of water is squeezed, water is drawn to its surface. In the electrical contact, the male and female elements serve as the sponges. Each of them is produced from a porous material. In place of water, a viscous compound (a polymer derivative) is used filled with very highly conductive submicron metallic particles (with an insulation between each particle of only a few angstroms). The electrical contact is then made by contact of the compound (polymer plus particles) infused into each of the two elements, male and female.

Advantages Already Itemized

Through mechanical compression of the casings of each element, which occurs by introducing one into the other as well as by the effect of compression applied by air, the metallic particles of the conducting compounds form a film on the external surfaces of the two elements. Upon the uncoupling of the male and female elements, the converse effect occurs. Insulation occurs as a consequence of mechanical decompression of the casings of the two elements and of depressurization by suction of the air.

According to Cetra, the list of potential advantages of such a contact (named CPAF, i.e., fluid-pump contact) over traditional metal-to-metal contacts is lengthy: elimination of surge upon closing the circuit; significant increase in nominal intensities; increase in the insulation resistance; significant improvement in very-high-frequency (VHF) operations; reduction of contact resistance; resistance to wear, etc. Not to mention that in addition to this two-element contact, Cetra seeks to develop a monolithic connection system in which the opening and closing of the electrical contact would be achieved by an external magnetic or photonic command, for example. According to Mr. Moisand, completion of the fluid contact research will require a minimum of four more years of work and an investment of 12 to 15 million French francs. "We have not yet won, but if the project succeeds, this would be a fundamental breakthrough," he declared.

Duisburg Fraunhofer Microelectronics Institute To Expand, Integrate Former Dresden Microelectronics Center

92P60019A Duesseldorf VDI NACHRICHTEN in German 23 Aug 91 p 34

[Article: "Chip Know-How From Duisburg and Dresden Is Interwoven"]

[Text] The interest of industry in developments in the area of microelectronics is great and has helped the Duisburg Fraunhofer Institute for Microelectronic Circuits and Systems (IMS) become a successful organization since it was first established. Now the institute's head, Prof. Gunter Zimmer, is able to present to the public two plans for expansion at the same time.

In the one, the Duisburg Institute building, completed in 1987, will be expanded in a second construction stage by about 1500 square meters. In the other plan, a branch of the institute will be established in Dresden with 120 employees. With that not only will Zimmer run the largest such institute in old laender, but IMS also will occupy a leading position in today's German republic (FRG).

In particular, the specific know-how of the institute's new branch, formerly part of the Dresden Microelectronics Center (ZMD), is to be used. Originally ZMD was the agency for industrial microelectronics in the ex-DDR. The scientists and engineers there have considerable experience on especially the issues of yield and redundancy as well as in the area of circuit simulation.

The Duisburg branch of the institute contributes to the whole plan its experience in the design of application-specific integrated circuits (ASIC) in prototype production, and in system design. Also essential is the successful translation of the Fraunhofer model for contract research. Here Zimmer can boast that his institute is in a top position among all microelectronics institutes. About 50 percent of the institute's operational budget is covered by industrial projects and another 35 percent by public projects, with about 60 percent of the industrial contracts coming from small- and medium-sized companies.

The current planning for the Dresden branch of the institute runs until 1994. Zimmer named 25 percent self-financing as a condition for the branch's continuation beyond this period. Individual research fields that are still understaffed in Duisburg will be stressed at the start of the combined program.

Institute leader Prof. Zimmer says, "The concept of an institute with sites in both Duisburg and Dresden makes it possible to develop both here and there our own profile for application-oriented developments, and to serve at the same time the research and development market in both the old and the new German laender. For broader investigations, in Germany's largest microelectronics institute with presently about 330 employees, the synergism that occurs in solving problems will be significant."

To take up the new task, the Dresden facility was reorganized and retraining measures now are being implemented in all fields. Ten female and male employees of the former Central Institute for Cybernetics and Information Processes (ZKI) of the Academy of Sciences in Dresden expand the know-how-spectrum of the former ZMD staff in the area of system design and application-oriented hardware development.

On 1 January 1992, membership in the Fraunhofer Society will be legally executed. The organization and first projects are of course already under way. During the coming three years 18 million German marks [DM] in investment funds will be provided and DM57 million will be allocated for the operational budget during the same time frame. The Duisburg branch of the institute should earn an increasing share of the budget itself through project revenues. According to Zimmer, judging things as they are today, it is probable that by 1994 the Dresden branch of the institute will be taken over as a permanent establishment of the Fraunhofer Society.

Switzerland's Contraves To Increase Thin-Film Multilayer Activity

91AN0568 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 12 Sep 91 p 9

[Article signed F.F.: "Hybrid Circuits: Contraves Reorganizes Its Activities"]

[Text] The Swiss company Contraves is investing 7 million French francs [Fr] in developing the production of thin-film multilayer technology in its hybrid circuit plant, which is becoming independent.

Contraves, a Swiss company specializing in military equipment, in particular airborne equipment, has just split its interconnector technology division, which sells hybrid circuits and printed circuits on the open market, into two independent units. In all, this division generates a turnover on the order of Fr100 million, 75 percent from printed circuits and 25 percent from hybrids. The design and manufacture of hybrid thin-film circuits are

now carried out at the Lenzbourg plant near Zurich, by a division called MicroCircuits, which functions as an independent unit.

The multichip modules made using multilayer thin-film polyimide technology are the new division's strongest point. "Currently, this technology represents 10 percent of our sales, but it is likely to grow rapidly and to encroach upon the traditional thin-film hybrid circuit sector, in which multilayer circuits are not possible," comments Emile Sutcliffe, who is responsible for the general management of MicroCircuits. In this respect, an investment of 1.8 million Swiss francs [SFr] (nearly Fr7 million) is planned up till the end of 1992 in order to provide the plant with large-scale production facilities for this technology. Currently, demand for this type of module is for series of a few hundred units, mainly for telecommunications and computing applications.

Up to Five Conducting Levels With 25-Micron Features

The manufacturing resources to be constituted will make it possible to produce annual series of 1,000 to 10,000 units for complex modules with up to five conducting levels and 2,000 chip connection terminals. However, Emile Sutcliffe feels that they are already capable of satisfying demand for large series involving modules of medium complexity with 200 to 1,000 connections, which require two or three conducting levels. Multilayer thin-film technology with polyimide dielectrics, developed from 1984 onwards, makes it possible to produce modules with five conducting levels and 25 micron linewidths.

The hybrid thin-film activities of the MicroCircuits division are carried out almost exclusively on the open market for applications in the fields of instrumentation, avionics, military applications, and highly sophisticated telecommunications. In addition to the multichip modules, their products include high-precision resistor networks and single or double-sided hybrid thin-film circuits with metallized holes. MicroCircuits employs 25 people.

In Europe, Contraves considers that Thomson Hybrides is its main competitor on the polyimide multilayer thin-film market, and is the only one to have brought the technology to this level of production. Nevertheless, one should not forget the Pepite project, which has just become a EUREKA project for developing the design and manufacturing techniques needed to produce multichip modules. Four French manufacturers (Telecommunications Corporation (SAT), Sorep, European Silicon Structures (ES2), and Racal Redac Tad) have joined forces with 10 European partners (including STC and Newmarket in Great Britain, Alcatel Bell in Belgium, Nokia in Finland, and Saab Scania in Sweden) for this three-year program, which will cost Fr140 million. The French group, led by SAT, will contribute Fr61 million to the cost of the Pepite project. However, those involved do not want to reveal their research plans until the government subsidies have been allocated.

NUCLEAR R&D

Germany: DESY's Accelerator Cooling System Described

92MI0008 Duesseldorf HANDELSBLATT in German 9 Oct 91 p 27

[Article by Lutz Bloos: "Europe's Largest Helium Cooling System in Operation at DESY [German Electron Synchrotron]"]

[Text] Particle physicists all over the world are awaiting the first results from the new HERA [Hadron Electron Ring Accelerator] particle accelerator at DESY in Hamburg with excitement. The detectors will probably start collating the test results around the turn of the year, after the plant has undergone a trial period of nearly one year. The storage of protons and electrons at a high energy level for hours on end in the 6.3 km-long ring required the installation and, in some cases, the development of a great deal of advanced technology. This includes components for Europe's highest-capacity helium cooling plant on the DESY site.

Protons and electrons are held on the circular track by powerful deflection magnets, flying through it at a rate of about 50,000 per second. The beam is continuously refocused by focusing magnets. The field strength for the proton ring is so high that only superconducting magnets can produce it. In order to achieve and maintain superconductivity, the magnets installed in the curved sections of the proton ring have to be cooled to a temeperature of about 4K (-269°C), as superconductivity can be lost even at 4.6K. This requires a helium cooling plant, as no other refrigerant can achieve such temperatures. No superconducting magnets are needed for the straight stretches in the proton ring.

Cooling Hall With Three Liquefaction Lines

Seen from the outside, the plant consists of fifteen colossal 267-m^3 steel tanks. Five are filled with helium at a pressure of 20 bar as a reserve, whereas the other 10 are used to take the process helium when the plant is shut down and emptied. They stand on the eastern side of the cryogenic hall, whose 2,500 m^2 make it one of the largest above-ground buildings at DESY. Ten of the tanks are empty and are used to take the helium when the plant is shut down; while five are filled with the inert gas as a permanent standby reserve. The reserve also includes two liquid helium storage tanks, which are actively integrated into the system that controls the cooling circuits, and which can deliver their stored cold when required.

The cold for the entire proton ring, the superconducting coils of the H1 and Zeus detectors, and the superconducting high-frequency resonators of the electron ring, is generated centrally in the hall and distributed via conduits. There are three "liquefaction lines" installed in the cold hall on the DESY site, one of which acts as a standby. It can take over from either of the two other lines whenever they require maintenance or repair work.

The cooling capacity of two liquefaction lines is 13.6kW at 4.5K; the installed electrical power is 5.4MW.

There is an input unit for every four screw compressors, which not only make a deafening noise but also compress the helium as specified. The compression heat thus released is absorbed and drawn off by the compressor oil. The helium is then purified several times at room temperature of any oil droplets and oil mist still present. It passes through an activated carbon filter and helium dryer before flowing through a cleaner cooled with liquid nitrogen, where oxygen, nitrogen, and hydrogen residues are removed. After purification the inert gas enters the core of the plant, the cold boxes, in which it is cooled by stages to 4.2K. It is then liquid at atmospheric pressure. This procedure combines the Joule-Thomson and Brayton processes and is known to refrigeration engineers as the "Claude" process.

In the Joule-Thomson process, energy is extracted from the helium by expansion to a lower pressure. Part of the helium thus becomes liquid and is collected, the gaseous part being fed back into the Brayton process aluminum plate heat exchanger to precool the new helium input. Only a combination of these two techniques provides optimum cooling capacity.

Of particular technical interest are the Joule-Thomson process expansion valves, which are built as turbines. Seven of these are installed in each cold box. The helium drives 32-mm turbine wheels, which rotate at 150,000 rpm. No additional heat must arise as a result of friction.

Helium Used as a "Bearing Lubricant"

As no lubricant—which would also contaminate the helium—can be used at this low temperature, the process helium is used as a "bearing lubricant." The gas bearings are hermetically sealed to the outside. Small permanent magnets prevent mechanical contact between rotor and bearing when the turbine is at a standstill and facilitate start-up.

The helium energy converted in rotation is conveyed by a shaft protruding from the cold section to a second turbine rotor, the brake compressor, which drives a separate brake circuit. The expansion turbines were designed and built for the HERA cooling plant by Sulzer Escher Wyss in Lindau.

At the temperature of 4.4K the cold helium is then transported through two insulated conduits (each 3.5km long) in the ring to the eight distributor stations for the individual octants. The ring is divided into octants for cooling, each of which is separately supplied with cold. At a pressure of 3 bar, the helium is in a supercritical condition, because its vapor pressure at this temperature is only 2.3 bar. Expansion turbines are also installed at the end of the feed flow to draw off the minute quantities of heat absorbed in the proton ring. The return flow of the expanded helium is thus even slightly colder than the feed flow.

The proton ring magnets are housed in the cryostats, which resemble thermos containers. They enclose the steel pipe, the innermost component, and are flushed by liquid helium which flows through the conduits at a brisk walking pace. The magnets are stabilized by aluminum clamps and iron yokes that absorb the tremendous mechanical forces generated by the magnets. The yoke is cooled by the return flow of helium, which is in two phases part liquid, part gas after expansion.

This structure is enclosed by an aluminum shield pipe with a helium conduit soldered onto its internal wall to draw off the heat trapped by the aluminum sheath. Superinsulation up to the outer wall ensures that only minimal amounts of heat can reach the shield pipe.

Such a highly complex plant cannot operate precisely and reliably without modern measurement, control, and data technology. This is why there are 6,000 sensors recording data in the cold region, which they feed (in either analog or digital form) to the process computer in the cooling control room. They are then displayed to the operating personnel, who can make any adjustments that might be required.

If the ring is to be cooled down, liquid nitrogen is used to precool the helium, bypassing liquefaction and the cold boxes. Initial cooling to 80K also has the advantage that the magnets do not suffer shock damage due to the cold. It takes about 14 days and about 250,000 German marks' worth of liquid nitrogen to cool the whole ring. For this reason the ring is also intended to remain cold as long as possible, unless thawing out is necessary for technical reasons.

Germany: GSI's Basic, Applied Heavy Ion Research Described

92WS0014A Berlin ING DIGEST in German Sep 91 pp 43-45

[Article by Guenther Ludvik: "Synchrotron and Storage Ring for Heavy Ions: A System Unique in the Whole World"; first paragraph is ING DIGEST introduction]

[Text] Other labs such as those in Berkeley, California or Caen, France attain higher energies. At the GSI—The Society for Heavy Ion Research near Darmstadt—it is thus not considered very useful to copy what has already been successfully accomplished elsewhere. Consequently, the scientists developed an original concept, not only to accelerate heavy ions, but also to store them.

"We are not reluctant to accept such 'small gifts,'" says Dr. Guenter Siegert of the GSI administrative board. The "gift" is an approximately 100-metric-ton superconducting magnet which USSR scientists from the company ELEKTROFIZIKA of Leningrad have already had delivered here for integration into the research system soon. They are not the only ones—the waiting list of those applying to the experimental committee to use the unique research capabilities for a limited period is long. "We have more than 1,000 visiting scientists here per year, primarily from universities, as well as domestic and foreign research facilities," reports Dr. Siegert.

At GSI, one of 13 large German research facilities, approximately 650 employees, a third of them scientists, are currently involved in heavy ion research. They are devoting themselves to nuclear physics, nuclear chemistry, solid-state research, and radiobiology as well as to the construction and operation of large research instruments. The money to operate the system comes 90 percent from the federal government, with the state of Hesse contributing 10 percent.

GSI, founded in 1969, experienced another high point a little over a year ago: To supplement and expand the linear accelerator Unilac, the heavy ion synchrotron SIS and the experimental storage ring ESR went into operation—investments of approximately 275 million German marks [DM]. "Thus GSI has at its disposal a system of three accelerators which—as far as we know—is unique in the whole world."

The Darmstadt researchers caused an international sensation with the synthesis and detection of heavy elements numbers 107, 108, and 109 of the periodic system—which do not occur in nature. They appeared through collisions of accelerated heavy ions with metal films. A few atoms of 108, for example, came into existence through fusion of the nuclei of bombarded iron-58 with those of a lead-208 target. This took place in the linear accelerator Unilac, in operation since 1975, which can accelerate all chemical elements up to uranium to energies of 20 MeV per nuclear component. In the 120-meter-long line, the ions reach approximately 20 percent of the speed of light. "This is adequate for us," states Dr. Siegert. "If the accelerator were longer, we could come very close to the speed of light. For our tests the current size is optimum."

Currently, a program of 30 experiments is running on the Unilac. However, it is simultaneously being used as the pre-accelerator for the ring-shaped heavy ion synchrotron SIS. The ring with a circumference of 216 m actually consists of 12 straight line elements. Twenty-four dipole magnets keep the particles on their course. The acceleration takes place in two hollow spaces, in which high frequency of 0.8 to 5.6 MeV is stored. All ions can be accelerated here up to 2 GeV per nuclear component—i.e., 100 times the performance of the linear accelerator.

First, the ion beam coming from Unilac is stored during 30 orbits. In the subsequent acceleration, 250,000 laps are run. Then, the beam can be extracted quickly—during one orbit—for transfer into the storage ring or slowly—during a few hundred thousand orbits—to bombard a stationary target. The ions can also go to the experimental storage ring ESR which at 108 m has exactly half the circumference of the SIS. In the hexagon, highly charged ions with an energy up to 834 MeV per nuclear component can be stored. What makes it special? Even completely ionized, i.e., "naked" nuclei without any electron shells can be stored.

Dr. Siegert is particularly proud of the cooling lines in the ESR. According to a process developed in the 1970's by Soviet physicists in Novosibirsk, an electron beam of up to 10 A flies along with the ion beam in a 2-meter-long section. The "genius" of the process: The electrons have exactly the desired speed and direction of the ion beam. Deviating ions are either slowed down or accelerated by the electrons and thus adjusted to the desired value. Why is this called "cooling"? According to Dr. Siegert: "Deviations from the desired speed correspond to a irregular movement which can be determined by a temperature. The so-to-speak 'rectifying' electron beam thus becomes warmer and the ion beam is thus 'cooled.' The entire process occurs within a thirtieth of a second." Basically, all fluctuations in movement of the particles in the transverse direction are eliminated, thus forming an extremely smooth high-density stream.

The radiation tunnels pumped free of air and the irradiation sites and devices are shielded with thick concrete. According to Dr. Siegert, this is essential for safety reasons.

What are the scientists starting now with the expensive beam? Each hour of operation costs about DM20,000; the expensive time must be used as efficiently as possible. The major focus is nuclear physics. Scientists therefore want to heat, excite, and compress atomic nuclei by means of central collisions. It is thus possible to create conditions such as those which prevail in neutron stars or in supernova explosions.

With such highly compressed nuclear matter, it is also possible to test a potential for nuclear fusion, for fusion of hydrogen to helium through inertial confinement. In this process, a small hollow ball of frozen hydrogen (deuterium and tritium isotopes) is to be bombarded from all sides by intensive beams of heavy ions. The ions give off their energy in a very limited zone of the ball. The inner part of the hollow ball implodes. Extreme pressure and temperature are obtained in the center so that the hydrogen nuclei fuse and fusion energy is released.

Even the state of the universe immediately after the big bang can be artificially produced in the lab by the splitting of nuclear particles into quarks and gluons.

The ion beam lends itself not only to pure research but also to thoroughly practical applications. Industry uses the energy rich beam for drilling ultrafine holes—even angled holes, for example, for filter materials. Materials researchers are highly interested in generating high-density plasmas in solids. Implantation of accelerated ions into semiconductors and other materials could be performed with any type of atoms up to the centimeter range. Satellite systems are exposed in the lab to radiation conditions like those in space and tested for their sensitivity.

A biomedical experimental line is under construction. The German Center for Cancer Research and the Heidelberg University Clinic consider the heavy ion beam a suitable tool for therapy of localized cancer tumors. "It is advantageous that heavy ions are beamed into biological tissue with irregular contours according to depth and

effect," explains Dr. Siegert. "They have higher efficacy than other beams and spare the healthy tissue. Particle energy and deposition depths can be altered from pulse to pulse. Furthermore, our detectors enable accurate monitoring of dosage and penetration depths."

That makes it sound as if "everything is under control," as if nothing unforeseen is left which can shatter scientific models. However, in particle physics, so much still remains incomprehensible. Thus, atoms have been discovered which cannot actually exist. These quasiatoms appear for split seconds when a heavy ion flies so close to an atom that the electrons of the shells (the remains of the shells in the case of the heavy ions) unite with each other. Such an atom with 188 protons emerges from uranium and curium—a fantastic element number 188. Also, in such reactions the appearance of an electron-positron pair is observed, the origin of which cannot be traced to changes in the nuclear substance. Have the Darmstadt researchers stumbled onto the trail of an unknown neutral system or even a new particle?

SUPERCONDUCTIVITY

German Institute Develops New SQUID Manufacturing Technique

92P60058A Duesseldorf VDI NACHRICHTEN in German 1 Nov 91 p 22

[Article: "Made-to-Order SQUID's [Superconducting Quantum Interference Devices]"]

[Text] Hamburg University's Institute for Applied Physics has succeeded in developing a new procedure for manufacturing highly sensitive magnetic field sensors, so-called superconducting quantum interference devices (SQUIDs), from the ceramic high-temperature superconducting material yttrium-barium-copper oxide. With the procedure, the physical properties and sensitivity of the sensors for the respective areas of application can be made-to-order. At present, SQUIDs are used primarily in medical technology to measure the inherent magnetic fields of the heart or brain.

Germany: Growing Government, Industry Interest in High-Temperature Superconductivity

92WS0069B Duesseldorf VDI NACHRICHTEN in German 27 Sep 91 p 1

[Text] Following the discovery of high temperature superconductivity (HTSC) by the German physicist Johannes G. Bednorz and his Swiss colleague Karl Alex Mueller in 1986, industry began to show an increasing interest in high temperature superconductivity. The scientific director of the North Rhine- Westphalia Science Center (Wissenschaftszentrum Nordrhein-Westfalen), Dr. Magdala Gronau, sees a growing readiness to make results of this area of research available for energy technology, medical diagnosis, microelectronics, and communications engineering.

Because newly developed materials conduct electrical current without dissipation when cooled to the temperature of economical liquid nitrogen (minus 196°C), commercial interest has grown enormously. The German states of Baden-Wuerttemberg, Lower Saxony, and North Rhine-Westphalia offer insights into the technical and scientific prospects of superconductivity with the first "Symposium on Applied Superconductivity" from September 30 to October 2 at the Nuclear Research Center in Karlsruhe. "The Federal Republic makes a respectable showing internationally with their expenditures," says Prof. Hermann Rietschel of the Society for Applied Superconductivity.

Expenditures of the BMFT [Federal Ministry for Research and Technology] and industry come to about 120 million German marks annually. Along with the contract for the development of a SQUID [superconducting quantum interference devices] chip by Lower Saxony's Research Society for Information Technology (FIT, Forschungsgesellschaft fuer Informationstechnik), the first superconducting generator is ready for testing at Siemens.

TELECOMMUNICATIONS

European HDTV Equipment To Be Tested in 1992

91AN0545 Rijswijk POLYTECHNISCH WEEKBLAD in Dutch 5 Sep 91 p 1

[Article by Bart Stam: "HDTV [High-Definition Television] Sets To Be Tested During 1992 Olympics"]

[Text] The European manufacturers participating in the European HDTV project will test 1,000 special HD-MAC [high-definition multiplexed analog component] receivers during the 1992 Olympics in Barcelona. The equipment will be supplied primarily by Philips (Netherlands), Thomson (France), and Nokia (Finland).

The HD-MAC receivers are not intended for the commercial market, they are in fact just prototypes developed for trial purposes. These prototypes will gradually come off the production line as of November 1991. According to P.W. Boegels, who is working as an HDTV specialist for Philips, the actual HD-MAC receivers will become available to the general public from 1994 onwards. He thinks that it is important to know whether viewers having a D2-MAC [Definition 2 Multiplexed Analog Component] compatible set will be able to receive the HD-MAC signals. He made these statements during the International Radio Exhibition (IFA) in Berlin.

Since 1986, some 32 manufacturers, research institutes, broadcasting corporations, and television and film producers have been cooperating in the EU-95 EUREKA project for the development of high-definition television in Europe. D2-MAC is the intermediate step toward the final introduction of HDTV. This year, several electronics companies started marketing their special D2-MAC receivers to the general public.

Boegels also said that the European consumer electronics industry is busily developing HDTV equipment for

applications other than television programs. According to Boegels, these developments involve standards for multimedia applications. "The combination of HDTV with CD-ROM (read-only memory) or CD-I (interactive) is one possible option. The new generation of HD-MAC laser disks is on its way," says Boegels.

Olympics

According to M. Oudin, general manager of the Vision 1250 European economic interest group, about 100 hours of television recordings will have to be produced in HDTV by the end of 1991. One year later, the share of HDTV recordings should increase to about 1,000 hours. The Brussels-based Vision 1250 group coordinates the activities of companies, of the European Broadcasting Union (EBU), and of commercial and state-controlled broadcasting organizations. Major events to be recorded in HDTV next year include the Winter and Summer Olympics and the World Exhibition in Seville.

In the meantime, the German city of Oberhausen boasts a very sophisticated studio for the production of HDTV programs. The purpose is to allow producers from all over Europe to gain experience with the new medium.

French Firm Unveils Next-Generation Network Hub

92WS0062B Paris ROBOTS in French 30 Sep 91 pp 4, 5

[Article: "Ungermann-Bass: Next-Generation Network Hub"]

[Text] The demand for networking services is expanding rapidly, as big international companies count on them to ensure proper functioning of critical applications and improve their global competitiveness. To meet these needs, Ungermann-Bass (UB)—which pioneered networks and dominates the market—has just announced revolutionary upgrades to the central element in its Access/One network hub to provide users a broad spectrum of options for building and managing vast, complex networks.

Based on UB's new PlusBus high-speed interchange architecture, Access/One is the first intelligent network hub to provide advanced RISC [Reduced Instruction Set Computing] performance, trouble-free LAN/WAN [local area network-wide area network] integration, and support for new applications such as multimedia. New expandable Access/One backboards will also support access to a wide gamut of network applications, such as mainframe gateways, catalogs, and security services.

UB's network hub strategy is based on the existing Access/One architecture, thus ensuring that current users will not be penalized for their investments to date. When the product was introduced in 1988, each Access/One was equipped with a PlusBus backboard, but until now it has not been used. The change-over to the PlusBus interchange architecture with its new functionalities will not make any Access/One environment obsolete.

The improved network hub overcomes the limitations of today's hubs by providing interfaces to network applications and services, thus creating a truly open "bus platform," says Ralph Ungermann, UB's president and CEO [chief executive officer]. By offering all services on the same bus, PlusBus architecture emphasizes integration and makes improved management much easier than with an architecture based on multiple single-function buses.

Matra Launches French Industrial Videophone

92AN0007 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 26 Sep 91 p 2

[Text] Built by Matra Communication, a French videophone called "Visages" is now ready for industrial production.

Its price of 80,000 French francs [Fr] will limit its applications to purely business ones. "Our ambition is to position ourselves in the videophone market without delay," says Matra Communication Vice President and Managing Director Jacques Payer. Matra Communication has chosen to face the Japanese with a first-generation videophone: a cathode-ray tube monitor, a digital telephone terminal, and a three-card coder-decoder (codec).

The terminal stems from the pooled competences of both the National Center for Telecommunications Studies (CNET) and Matra Communication. Officially launched in early 1987 but in the CNET plans since the early eighties, the "Visages" project was initially aimed at developing the elements required for a transmission service for data, sound, and color pictures along the integrated services digital network (ISDN). The project required an investment of some Fr100 million over 10 years. Matra Communication acquired the "Visages" license in 1989 and the ensuing cooperation enabled the industrial teams to master the video codec technology, the bulk of research work having centered around the development of image compression-decompression algorithms.

The results are here today. The videophone will be produced at the Douarnenez factory and the manufacturer insists that "this factory is now equipped to produce the terminal in runs of several thousands."

In the longer term, Matra Communication is to upgrade this technology (especially the integration of codec functions into a component) to lower its price and position it in the retail market.

The videophone is one of France Telecom's great challenges and it aims to offer videophone terminals at under Fr5,000 by 1995.

France To Apply Synchronous Digital Hierarchy Standard

91AN0555 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 5 Sep 91 p 28

[Article by Pierrick Arlot: "France Takes the 2.5-Gbit/s Road"]

[Excerpts] With the backing of the CCITT [International Telephone and Telegraph Consultative Committee] standard, France Telecom has ordered its first long-distance transmission equipment which will eventually lead to 2.5 Gbit/s speeds.

The development toward very high speeds on the national long-distance telecommunications network is currently approaching its practical implementation phase. During the month of August, France Telecom selected Alcatel-CIT and SAT [Telecommunications Corporation] to supply optical digital transmission equipment in line with the new "synchronous digital hierarchy" standard (standard commonly known as SDH which has just recently been accepted by the CCITT) and which should allow speeds of up to 2.5 Gbits/s on the intercity network.

France Telecom decided in March 1990 to expedite the setting up of the optical infrastructure on the national long-distance network. By 1995, about 17,000 kilometers of monomode fiber-optic arteries should crisscross France to accommodate 18 million telephone lines. This speeding up is linked to the existence of the new SDH standard, which, among other things, determines the basic data rates and organization on high-speed optical networks. It should be recalled that the operation of a communications system is divided into communications and monitoring operations, on the one hand, and time-division multiplexing operations, on the other. [passage omitted].

According to France Telecom, the cost of equipping the intercity network in optical transmission systems could be about 1 billion French francs [Fr]. Several phases have been scheduled to introduce the synchronous technology. The first phase will be to install high-speed STM-4 and STM-16 synchronous transport modules and RPN 4/4 automatic distribution frames. These will control plesiochronous 140-Mbit/s digital access ports or synchronous 155-Mbit/s access ports and will be destined to equip interconnection networks which will progressively substitute the current 140-Mbit/s security switches. The STM-4 and STM-16 line systems, which also include 155-Mbit/s or 140-Mbit/s digital ports, will initially be complementary to and subsequently replace the current 565-Mbit/s plesiochronous line system.

Advantage of Monomode Fibers

According to France Telecom, the installation of the first SDH-based equipment is scheduled for mid-92. As for the synchronous distributors [brasseurs] which will enable SDH to be used to the full, we will have to wait for the second phase of the program for which the national operator has had to issue a new call for bids. "The decision to launch SDH in the communications network today puts us on a par with other European countries. With the added advantage perhaps of having chosen monomode fiber which is fully adapted to these new systems," said Mr. Dupire, head of the external research and development department of the DRI at France Telecom.

Alcatel-CIT will supply the digital distribution frames and line equipment jointly developed with its German subsidiary SEL of the Alcatel NV group. SAT will supply to France Telecom the STM-4 and STM-16 systems, which were developed in collaboration with GEC-Plessey Telecom and Siemens. [passage omitted]

Siemens is also actively participating in the Berlin V project being conducted under the aegis of Deutsche Bundespost Telekom in order to develop 2.5-Gbit/s fiber-optic transmission systems in accordance with the new synchronous hierarchy standard.

Philips' D2-MAC Decoder Described

91AN0563 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 19 Sep 91 p 21

[Article by Elisabeth Feder: "D2-MAC [Definition 2 Multiplexed Analog Component]: Almost As Easy To Decode As Secam"]

[Text] Philips wishes to rival ITT Semiconductors on the market for integrated circuits designed to decode D2-MAC signals.

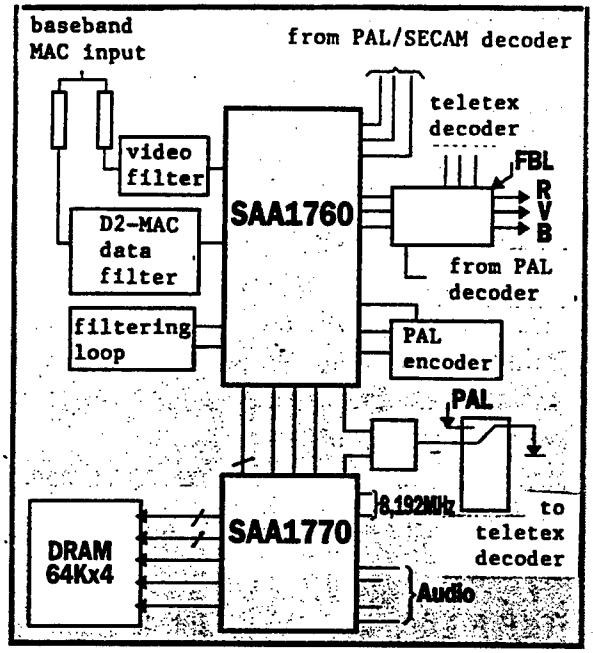
With a view to the manufacture of low-cost TV receivers which are compatible with the intermediate D2-MAC standard, Philips' semiconductors division is developing a low-cost unit for decoding audio and video signals. This decoder, based on two circuits, is the second generation designed by Philips (the first generation, marketed last year, was a universal unit able to decode all variations of the MAC standard). With this set of circuits, which is designed for an analog environment but is able to adapt to either a 4/3 or a 16/9 format, Philips considers itself able to offer a better price/performance ratio than the D2-MAC decoder developed by ITT Semiconductors, a unit which is basically designed to work in the digital environment of the latter company's Digit 2000 circuit series.

Samples are planned for next spring and production should begin during the second half of the year.

The development of this set of circuits is currently being carried out under the responsibility of Philips' applications center in Southampton, UK, in cooperation with the Norwegian company Nordic VLSI, with which Philips had already worked on its first-generation D2-MAC decoder. The various necessary functions have been divided logically between the two integrated circuits, referred to as SAA1760 and SAA1770. The first circuit handles image decompression and decoding as well as clock and data regeneration. Data acquisition and processing, among other functions, are performed by the second circuit, which takes care of synchronization, 625-line processing, frame processing, and sound processing. The two-way link between the two circuits is designed to make them appear to be a single peripheral unit, programmable through an I^2C bus directly linked to the SAA1770.

The baseband D2-MAC signal which arrives at the video input of the SAA1760 component is digitized over 8 bits, decompressed, and decoded if necessary. After the filtering and digital/analog conversion stage, two analog YUV outputs are available. One is a MAC output which can, for example, be linked to a PAL [Phase Alternation

Two Circuits Make Low-Cost D2-MAC Decoder



Building a D2-MAC decoder with the SAA1760 and SAA1770 integrated circuits requires few peripheral components.

Line] or Secam encoder to generate the signals needed by a video recorder. The other output can be multiplexed with a YUV signal from another decoder or analog source, which is an interesting option for multistandard receivers equipped with a single RGB (red-green-blue) signal processing unit. The SAA1770 rebuilds the packets of D2-MAC data. The sound decoding system, with three acquisition channels, including two in stereo, allows various mixing methods or multiple-language broadcasting.

German University Studies Wide-Band Glass-Fiber Cable Network

92WS0066B Duesseldorf VDI NACHRICHTEN in German 13 Sep 91 p 33

[Article by Richard Sietmann: "The Entire University Becomes a Laboratory for Wide-Band Technology: Technology and Applications of Future Communications Paths Researched in Berlin"]

[Text] Prerequisites for introducing glass-fiber wide-band cabling are a wide range of services and high-speed terminals. The Technical University of Berlin is now doing research with its own network.

The Technical University wide-band communication network called Tubkom is a fiber-optic cable run that extends for 9 km. The network connects 10 Technical University buildings in a star configuration. These buildings house a total of 40 Institutes in the central city area of Berlin. The network contains 25 glass- fiber cables in each leg installed by AEG-Kabel.

This test bed has two goals. The first is to investigate network operations. The second is to insure that the network has a wide bandwidth up to the terminals. In this way, the properties and requirements of high-speed terminals having transmission rates of initially 100 and later 140 Mbits/s can be investigated.

In Tubkom, the Technical University of Berlin has the first glass-fiber campus network for research and teaching purposes in the Federal Republic. Until now, glass-fiber networks only interconnected existing local-area networks (LANs) within university computer centers. Such configurations can handle a greater number of EDP [electronic data processing] stations by multiplexing the data flow. However, the low bit rates of the individual LANs and workstations continued to set the point-to-point transmission rate between individual users.

Practical considerations advocate expanding Tubkom initially in the first expansion phase as a FDDI [fiber-distributed data interface] dual token ring. These considerations are the availability of workstations in the market. Under the FDDI standard, a total of 22 commercially available workstations can connect to one another. The FDDI transmission rate is somewhat less than the 140 Mbits/s planned for the B-ISDN [integrated services digital network]. However, it is still six to ten times greater than the 16 Mbits/s of IBM token rings or the 10 Mbits/s of Ethernets introduced for the LANs. The second stage of Tubkom calls for B-ISDN.

However, the practical use of these data rates requires both high-performance workstations and servers and the development of suitable software and hardware. "Therefore, one of the research plans for the network operation project is to help improve specific hardware and software for the FDDI stations," sketches Wilhelm Anacker one of the goals. He is a specialist for computer architectures and responsible for network operation. In addition, the project will experiment with new types of applications and multimedia workstations within the boundaries set by the FDDI standard.

"It is the task of the network operations project to insure the interaction of stations from different manufacturers," explains Anacker. The FDDI adapter cards required for directly connecting workstations and servers are only available as commercial products now on a limited basis. This is because industry is still developing them. However, the project has made agreements with the pertinent companies for the provision of prototype hardware and software to remain in a constant and close technological relationship.

The next stage of the network has already come into focus. In this stage, a gateway will connect the FDDI ring to the Berkom project of the DBP [German Post Office] Telekom. Berkom (Berlin Communications Network) is a pilot project for the 140 Mbits/s B- ISDN of the future. The connection will make it possible to operate Tubkom

as a private branch exchange of a—still experimental until now—public wide-band network.

These network studies are to advance glass-fiber-based transmission technologies, multimedia real-time communications, and open architectures of heterogenous systems, scenarios and strategies for introducing the social and economic attendant research. However, these investigations are only part of the task. The other part addresses the study of applications.

Transmission rates of 100 or 140 Mbits/s permit remote access to image and CAD storage in real time. These transmission rates represent a performance increase of four orders of magnitude over Datex-P and about three orders of magnitude over narrow-band ISDN. A 10-Mbit file is a volume typical of a rather complex design drawing. Sending such a file would take 17 minutes with Datex-P and would still take 2.6 minutes with ISDN. With B-ISDN, on the other hand, it would only last 0.07 second. In this way, it would be possible to simulate and animate dynamic processes during a design calculation.

"In this way, data transmission is no longer a time-critical aspect for many tasks. Many people, distributed over different sites and partners within a communications system, can contribute to new solutions," says Horst Nowacki. He is a professor for marine technology and one of the initiators of the campus network. "To open this broad new application potential is the object of the research work for Tubkom."

The wide-band multimedia communications forms in teaching make the spatial concentration of pupils unnecessary. "Remote teaching can, in the ideal case, be better than conventional instruction. This occurs when many subject groups are very well prepared and offered with access to several sources of information. They must be substantially supplemented with sequences of moving pictures," says Manfred Krause, convinced. He is a professor at the Technical University Institute for Communications Science. "It can serve to improve the student-to-teacher ratio and thereby increase the motivation to learn and the success of learning."

A corresponding Tubkom project will allow empirical examination of these expectations. The federal and state governments financed the installation of the glass-fiber campus network with 3.7 million German marks according to the Act to Promote the Construction of Universities. The twelve research projects now running have total support amounting to 10.7 million German marks. These projects use funds from third parties. Of these, 7.5 million German marks come from the Berkom project of the DBP Telekom. The EC furnished about 2.6 million German marks, and industry is providing the rest.